Potential Effect of Soil Bank and Corn Allotment Programs on income and resource use, Southern Iowa

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SUMMARY

This publication provides information on the potential ability of certain alternative production-control programs to influence output, use of resources, and individual farm incomes. The potential ability of alternative types of soil-bank, corn-allotment, and price-support programs to effect intrafarm equilibrium was determined by comparing profit-maximizing farm plans for typical farms under alternative programs with profit-maximizing plans for the same farms without a program. In this analysis of supply response to production-control programs, the technique of linear programing was used.

The three types of programs studied were: (1) An acreage allotment-price support program with supplementary acreage reserve and conservation reserve of the kinds used in 1956; (2) a base-acreage-for-corn program with soil-bank-acreage base, price support, acreage reserve, and conservation reserve of the kind rejected by farmers in the 1956 corn referendum; and (3) a corn allotment-price support program with acreage reserve and conservation reserve of the types used in 1957.

Compliance with each of the three programs *with no change in production practices* would require changes in the profit-maximizing organization and would result in changes in net income for typical owner-operated 160-acre and tenant-operated 240-acre cash–grain and livestock farms in southern Iowa.

Farm income would be increased considerably for cash–grain farmers (16 percent for owner-operators and 29 percent for tenant-operators) who complied with a 1956-type program. Income would be increased moderately (12 and 21 percent, respectively) for cash–grain farmers who complied with a soil-bank base-acreage-for-corn type of program. It would be increased less (1 and 11 percent, respectively) for cash–grain farmers who complied with a 1957-type program. This would be true with no change in production practices and with the price of free corn in all instances at $1.20 per bushel. In contrast, the net incomes of livestock farmers would be about the same whether or not these farmers participated in a 1956-type program, but their incomes would be decreased slightly (1.4 percent for owner-operators and 8 percent for tenant-operators) by participation in a soil-bank base-acreage-for-corn type of program and decreased moderately (11 and 20 percent, respectively) by participation in a 1957-type program. In making these estimates, it was assumed that production practices would not change and that weather would be average. The same market prices for livestock and grain were used for both participating and nonparticipating plans.

Production of corn would be decreased on all farms whose operators complied with any of the programs without changing production practices. Production would be reduced relatively more on cash–grain than on livestock farms and on large tenant-operated than on small owner-operated farms. In each instance, the percentage reduction in quantity of corn produced would be smaller

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than the percentage reduction in acreage planted to corn, as farmers would find it more profitable to use their best acres for corn.

Cash–grain farmers would find it profitable to place land in the soil bank and to reduce acreages of corn and oats below allotted levels. With average weather and the yields and prices used in the study reported, livestock farmers would find use of land for forage and production of other feed grains more profitable than placing it in the soil bank.

The three types of programs with the specified levels of price-support and soil-bank payments differ very little in potential ability to reduce production of feed grains if production practices are not changed. A soil-bank base-acreage-for-corn type of program is least effective in controlling production of feed grains on livestock farms. The soil-bank payments are not large enough to induce farmers to take many acres from production.

Livestock production on cash–grain farms would not be affected by any of the programs compared. The typical livestock enterprise on cash–grain farms—a small flock of chickens and about five milk cows—would still be the only livestock enterprise to compete with crop production for the limited capital resources. Expansion of dairy and poultry enterprises was not considered. Poultry buildings on these farms are small and most cash–grain farmers do not like to milk cows.

Under the plans set up, hog enterprises would be reduced relative to beef enterprises, which maximize profit for livestock farmers who comply with any of the programs. Because of the expanded forage production, beef enterprises could be increased on livestock farms. The returns from feeding to hogs corn bought for $1.30 a bushel or corn eligible for nonrecourse loans would be smaller than returns from feeding corn eligible only for sale at a market price of $1.20 per bushel.

Even though the combination of feed crops were changed and livestock production adjusted to utilize most profitably the new combination of feed, the total quantity of meat produced would not change markedly. In most instances, expansion of the beef enterprise would about offset the contraction of the hog enterprise in terms of total meat production.

The number of hours of labor needed to carry out the production plans would be the same as or smaller than those currently needed by farmers participating in any of the programs if production practices were not changed. This is due to decreases in acreages of corn and oats. The decrease in production of hogs and increase in production of beef cattle on livestock farms would cause a shift in the allocation of labor, but the total amount of labor needed would change very little. Labor is already underutilized on many southern Iowa farms, and it would become further underemployed on farms whose operators comply with any of the production-control programs analyzed. Thus production-control programs might speed up farm consolidation and rural-urban migration.

Capital requirements for operating cash–grain farms are smaller for those farms whose operators participate in any of the programs without using more fertilizer per acre or growing sorghums. Livestock farmers who participate in production-control programs have opportunities to shift capital from crop enterprises and hogs to beef cattle. Even without changing production practices, livestock farmers who participate in any program would be able to use as much capital as they currently use, or even more.

Land would be utilized less intensively, that is, with a smaller percentage in grain crops, by all farmers who participated in any of the programs, if they did not increase acreages of such uncontrolled crops as sorghums or soybeans. Usually, allocating some additional land to permanent pasture and removing some land from production through the soil bank would be profitable for participating farmers. Soil erosion would be reduced because the land would be used less often for intertilled crops.

The potential effects of the programs would also be influenced by the practices followed by farmers. Some changes in production practices would be likely to accompany compliance with the programs. The following changes in production practices would be profitable under a 1956-type program:

(1) Under a relatively high support level for, and a restricted acreage of, corn, increases in fertilizer rates per acre are profitable. On an owner-operated livestock farm in compliance with the 1956 program, net income would be $375 higher with a medium than with a low level of fertilizer application. Production of corn would be 2 percent below the noncompliance production with a medium level of application of fertilizer. With a low level of application, it would be 15 percent below.

(2) Although substitution of sorghums for corn is generally profitable in southern Iowa, it is especially profitable under certain types of production-control programs. If the difference between the support price and the market price for corn is small and there is opportunity to place part of the corn allotment in the acreage reserve, as was the situation under a 1956-type program, each acre of grain sorghum will be worth about $12 more than an acre of corn. By substituting 13 acres of sorghums for corn when complying with a 1956-type program, the farmer who owns and operates a 160-acre livestock farm can obtain a

net income $278 above the noncompliance level and $324 above the estimated net income under compliance without substituting sorghums. This method of compliance would increase total production of feed grains from 2,045 to 2,081 bushels, even though 13 acres of land were placed in the acreage reserve.

The value to the farm of marginal units of land would be raised by all programs. The value of marginal units of capital and labor would be reduced. Thus the alternative programs studied would probably encourage farmers who comply with them to try to obtain more land. Many livestock farmers who comply would find it profitable to shift some capital from livestock into land. If they attempt to buy more land to combine with their labor and other resources, they would tend to bid up the price of land.

INTRODUCTION

One approach toward solving the surplus problem attempted in the last 25 years has been production control. Aside from the World War II years, 1942–45, and the years immediately following, various types of control programs have been in effect since 1933. The latest to be used was the Soil Bank Program, which incorporated both acreage-reserve and conservation-reserve phases. In general, it has been necessary to initiate these programs and to distribute funds appropriated for them without adequate prior knowledge of their effects on income and resource use.

The study reported here involved an analysis of the effects of specific control programs—centered on the Soil Bank Program as originally enacted and initiated—on income, resource use, and output for selected farming situations in Iowa. This report does not include analysis of the relative efficiency of production-control programs in solving the basic problems of income and resource returns that currently face commercial agriculture. For purposes of this research study (but not in terms of the total means available to society), a particular type of control program is taken as given, and its impact on farmers operating under different capital, tenure, and managerial situations is examined.

The production-control program under analysis is that of the Soil Bank Act, which was enacted on May 28, 1956. The stated purpose of this act was to reduce surpluses and to protect and increase farm income by helping farmers divert part of their cropland from production of excess supplies of agricultural commodities.

The Soil Bank Program was supplementary to the acreage-allotment and marketing quotas authorized under the Agricultural Adjustment Act of 1938, as amended. The original Soil Bank Program consisted of two parts—an acreage reserve and a conservation reserve. The acreage reserve, which was discontinued after 1958, was an annual land-renting program designed to help farmers reduce production of corn, wheat, cotton, rice, tobacco, or peanuts. Farmers who participated in this phase of the program reduced acreages of control crops on a year-to-year basis and harvested no crop from the reserved acreage. They either left the land idle or put it under soil conservation practices. Payments were made to farmers to compensate for the income they would otherwise have received from crops grown on the reserved acres. The conservation reserve is a longer range program. Under this part of the Soil Bank Program, farmers contract to retire cropland into an approved conservation practice for not fewer than 3 years and not more than 10 years.

Costs of alternative programs are important in policy decisions relative to programs to attain specific ends. However, no estimates of program administrative costs are made here. The reader is referred to historical records of direct Treasury costs of past programs (*12*) and to estimates by the Department of Agriculture of direct future costs (*13*).[2] Total costs of a particular control program include also the indirect cost to the consumer of increased food prices and the greater costs of food production resulting from program restraints. Estimation and comparison of program costs were deemed to be outside the scope of the study.

OBJECTIVES AND PROCEDURES

The specific objectives of the study reported were: (1) To learn the conditions under which a soil-bank type of program is or is not profitable to individual farmers; (2) to analyze the effect of each of three soil-bank type-of-production-control programs on income, composition of output, and resource use on typical farms in one area of

[2] Italic numbers in parentheses refer to Literature Cited, p. 23.

the Corn Belt—the southern Iowa hog–beef raising area, which is part of generalized type-of-farming area V–H1 (*9*) or economic subregion No. 71 (*10, v. 1, pt. 1*); (3) to estimate the differential effects of the programs on farms that differ as to size, tenure arrangement, amount of capital, and production techniques or management practices; and (4) to estimate the relative effects of various levels of payment and program restrictions in controlling output in the farm situations studied.

To accomplish these objectives, the analytical procedure observed was as follows:

Estimates of the effects of the farm programs on income, output, and resource use were made by comparing the profit-maximizing plan for a farmer participating in the program with the profit-maximizing plan for the same farmer if he did not participate in the program.[3] Linear programing was used to accomplish the intra-firm phase of the analysis (*3, 4, 1*). Differential effects of the program relative to farm size, tenure arrangements, production or management techniques, and price structures were determined by varying land resources, tenure arrangements, production practices, and prices one at a time. In each case, optimum plans were computed for the farm in the program and compared with the optimum plan for the same farm if its operator did not participate in the program.

The effects of changing such program provisions as payment levels for sealed corn or acreages placed in the soil bank were analyzed by means of modified simplex programing procedures (*5*). In one modified procedure, the criterion vector for the profit-maximizing combination of activities was used to determine the extent to which levels of payment might be changed before an optimum farm organization becomes suboptimal. The price variable was changed to this extent, and a new optimum plan was calculated. The differences in magnitudes of variables in the activity vectors were then used to indicate changes in farm production resulting from variation in payment levels. The effect on farm organization and income of changing the levels of acreage restrictions was estimated by the programing modification, which permitted analysis of variable resource restrictions (*2*).

ANALYTICAL SETTING

The hog–beef raising section of the Corn Belt, which includes south-central Iowa, north-central Missouri, and southwestern Illinois, was settled earlier than were areas of the Corn Belt farther north and west. Original settlement was in fairly small owner-operated units. Although improved technology has encouraged consolidation of these smaller units, consolidation has not moved fast enough to allow farm incomes to keep pace with nonfarm incomes. Nor has it resulted in farms that are large enough to produce at minimum costs. Although industry is of relatively minor importance in the area, 35 percent of the farmers in the area had some nonfarm employment in 1954.

Because of the large amount of permanent pasture in the hog–beef raising area, the concentration of corn per square mile is relatively low. Of the cropland in this area, 31.3 percent is devoted to corn. Sales of hogs provide 31 percent and sales of cattle 25 percent of the gross income. Hogs represent a smaller percentage of total farm income than they represent in other parts of the Corn Belt. The position of the area relative to the national corn–hog–cattle economy is indicated in figure 1.

The cattle herds of the area consist mainly of good-quality beef cows that are kept for production of feeder calves. Herd size is limited by the supply of summer forage from the unimproved bluegrass pastures. Beef cows utilize the forage in these low-producing, brushy pastures, in which water supplies are limited, more profitably than do dairy cattle. Nevertheless, one-third of all cows are milk cows. Cream is sold to local creameries for making butter. There is no market in the area for grade A milk.

Hogs are produced on 75 percent of the farms. They consume most of the corn raised. As herds usually contain fewer than 10 sows, average efficiency is below that of several other areas of the Corn Belt.

The estimated yields for crops in alternative rotations are for the Shelby–Grundy–Haig soil association (*6*), as it occurs in Clark and Ringgold Counties of southern Iowa, but they are fairly representative of the whole hog–beef raising area. The topography is rolling to hilly and has three main phases—level uplands, rolling to sharply breaking areas along streams, and flat bottomlands bordering the streams. These three phases are intermixed throughout the area, and most farms have some acreage of each.

[3] Additional analyses that relate to other areas and to other alternative programs are in progress.

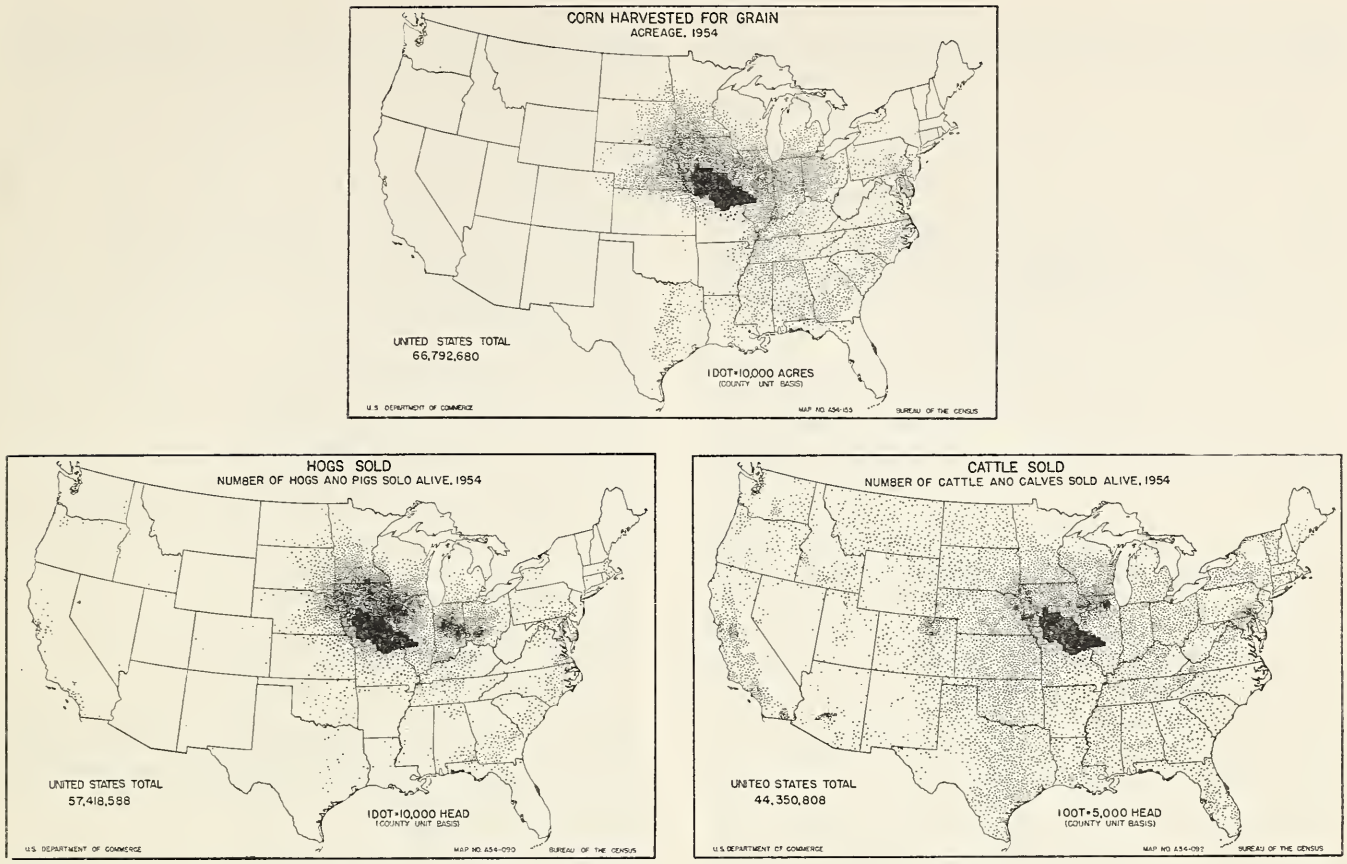

FIGURE 1.—The study area is the livestock and pasture area in the southern part of the Corn Belt, in which production of corn, hogs, and beef cattle predominates. (Based on maps from Bureau of the Census.)

Major soil types in the Shelby–Grundy–Haig soil association are closely related to topography. Grundy silt loam, the most productive soil in the area, is the major upland soil. It is found on slopes ranging from 2 to 8 percent. Haig silt loam, which is located on very flat uplands with slopes of less than 1 percent, is fertile but suffers from inadequate drainage. Shelby silt loam, a light-colored soil of low productivity, is found on breaks and hillsides; it ranges in slope from 4 to more than 30 percent.

As erosion is a problem on steep land, and especially on Shelby soils, much of it is left in permanent pasture. Although erosion has reduced the natural productivity of the land, pressure for immediate income has inhibited its shift to extensive uses. Terraces are seldom used for mechanical erosion control because the slowly permeable subsoil necessitates graded terraces and adequate outlets, which need careful management for satisfactory operation.

The Farms Studied [4]

Four farm situations were selected to represent the most common types of farm organization, tenure arrangements, sizes, and quality of farms in the area.

Types of farms.—Cash-grain and livestock situations were selected as the two most numerous farm types in the hog–beef raising area. These two types of farms differ widely as to compliance rates and methods of adjustment to production-control programs (*8*). Cash-grain farmers—those who receive more than 50 percent of their gross income from the sale of grain—constitute 22 percent of the total. Farmers who receive 50 percent or more of their income from sales of livestock other than dairy and poultry comprise 57 percent of all farmers in the area.

Tenure of farms.—Both owner- and tenant-

[4] Information on types of farms, size of farms, acreage and production of crops, and number and kinds of livestock on typical farms for the hog–beef raising area was obtained from the 1954 Census of Agriculture (*10, v. 3, pt. 8*).

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operated farms were studied because the effects of the programs on incomes and resource use differ between types of tenure. Full tenants comprise 23 percent of all farms, and the most typical rental arrangement is a crop–share–cash lease. Under this lease, the tenant pays half the corn and soybeans, two-fifths of the oats, and cash rent for land in forage. Cash rent is typically $7 per acre for cropland meadow and $4 per acre for permanent pasture. Landlords are eligible for price-support loans if the farms they own are in compliance with the program.

Size of farms.—The most common sizes of farms are the 160-acre owner-operated farm and the 240-acre tenant farm. However, in determining compliance with support programs, the size of the farm is relatively less important than are other factors.

Quality of farms.—The quality of the farms studied is reflected in their yields. Average yields were used in the study and average managerial skills were assumed. Crop yields are based on a moderate degree of erosion, a crop rotation, and uniform application of the total amount of fertilizer currently used. An above-average level of crop management was investigated later in the study; the results are reported in tables 1 and 2 (method II).

The quality of the farms is indicated also by the acreage of each grade of land they contain. Grundy–Haig silt loams of 0 to 8 percent slope, or class A land, comprise about 40 percent of the cropland. Shelby silt loam of 4 to 7 percent slope, or class B land, accounts for 10 percent of the cropland. Shelby silt loam of 8 to 12 percent slope, or class C land, makes up 50 percent of the cropland. Although this distribution of land classes is subject to considerable variation, it is about average for the area.

The four typical farm situations studied are explained briefly below. Additional information about each farm's resources, alternatives, and input–output relationships is given later in the report for those readers who are interested in the detailed data used in making the analysis.

Farm situation 1 is a cash–grain farm of 160 acres operated by its owner. The soil is moderately eroded. Crops occupy 109 acres, and 37 acres are used for permanent pasture. Only limited amounts of capital and labor resources are used in the livestock program, which consists of a small poultry flock and five milk cows.

Farm situation 2 is a cash–grain farm of 240 acres operated by a tenant with a crop–share–cash lease. The soil is moderately eroded. Crops occupy 154 acres, and 69 acres are used for permanent pasture. Limited amounts of capital and labor are used in the livestock program, which consists of a small poultry flock and five milk cows.

Farm situation 3 is a livestock farm of 160 acres operated by its owner. The soil is moderately eroded. The farm includes 109 acres of cropland and 37 acres of permanent pasture. Enough livestock is kept to utilize all the grain and forage produced on the farm.

Farm situation 4 is a livestock farm of 240 acres operated by a tenant with a crop–share–cash lease. The soil is moderately eroded. Crops occupy 154 acres, and 69 acres are used for permanent pasture. The tenant has sufficient capital to process his share of the grain and all of the farm's forage through livestock.

Assumptions

If this laboratory-type analysis is to be relevant to farm situations, the following conditions must hold:

First, certain important characteristics of the farms must be accurately identified and measured. These are the combination of resources available, the alternative enterprises considered, and the transformation coefficients that relate the resources to products. These data are presented later in this report.

Second, the results from the individual farms analyzed should be applicable to many similar farms. If individual farms within a group of farms have similar resources, alternatives, and input–output relationships, their profit-maximizing farm plans should be similar. Thus, aside from subjective, nonprofit variables, their response to government programs should be similar also.

The crop and livestock yields used are those obtained in average conditions of weather, disease, pests, and management. In years of exceptional weather or other unusual conditions, production would differ from that estimated in this analysis. Farmers with exceptional abilities would find it profitable to organize their farms differently from the plans presented in this analysis—either when complying with production-control programs or when not participating in these programs.

If the results of the analysis are to be used for estimating what farmers in the hog–beef feeding area will actually do under the conditions assumed, two additional conditions must hold: (1) The profit-maximizing plan for the noncompliance situation must approximate what farmers were doing before participation in the program; (2) to maximize profit, farmers must adjust to produc-

tion-control programs. Because farmers do not maximize profit alone, allowance must be made in the results presented in the section that follows for the subjective values of farm families that affect the actual supply response to the specified programs.

A 1956-TYPE PROGRAM

The first program analyzed here is called a 1956-type program. It includes acreage allotments, price supports, and both acreage and conservation reserves. The analysis develops estimates of long-run (4 to 5 years) changes in profit-maximizing farm organizations induced by the program. The analytical results differ from the effects observed in 1956 because of the influence of farmers' subjective values and because the program operated for only 1 year and with a late sign-up date.[5]

Under the 1956 program for corn, a farmer participating in the acreage reserve had to comply with all base acreages, reduce his acreage of corn by 5 acres or more below the base, and put at least 5 acres in the acreage reserve. He was then eligible for payment in the acreage reserve. To be eligible for conservation-reserve payments, he could plant up to his base acreage but had to put at least 5 acres of cropland in the conservation reserve. Eligibility for the corn support price required that the farmer not exceed his corn acreage allotment. Farmers could participate separately in each part of the 1956 program.

Comparison of Optimum Farming Systems on Cash–Grain Farms

Cash–grain farming is represented in this analysis by an owner-operated 160-acre farm and a tenant-operated 240-acre farm. Little livestock is kept on these farms. Most of the grain is marketed directly. There are about 80 tons of surplus forage. Usually, the unneeded and unsalable pasture and hay are left standing in the field or plowed under as green manure.

Cash–grain farmers on small farms with a minimum amount of operating capital are unable to utilize all their labor effectively. Approximately 1,345 to 1,705 hours of labor are needed to operate the farms with modern machinery. Excess labor remaining from an average annual supply of 3,000 hours is utilized partly through employment off the farm. In 1954, for example, 11 percent of the cash–grain farmers in the area earned more income from nonfarm sources than from the farm. Forty percent worked off the farm. Twelve percent were more than 65 years old and thus were in semiretirement (*10*, *v. 3*, *pt. 9*, *ch. 7*, *p. 32*). Because of the overlapping of these percentage groups, estimation of the actual underemployment of labor in the area is difficult.

Owner-operated cash–grain farms.—Optimum farm plans for a 160-acre owner-operated cash–grain farm without a program and with several alternative optimum adjustments to a 1956-type program are presented in table 1. This farmer would receive an estimated net cash farm income of $2,160 without complying with a production-control program. By complying with a 1956-type program, he could increase his cash income by $353 without changing production practices. He could increase his cash income by $549 by complying and increasing fertilizer application rates, or by $591 by substituting sorghums for corn and placing part of his allotment in the acreage reserve. Thus a cash–grain farmer would have strong economic incentives to participate in a 1956-type program.

Compliance would encourage a change in his production practices. This analysis indicates that changes in certain production practices are more profitable when a farmer participates in a control program. Increasing the level of fertilization without the program is estimated to return $1.75 for each additional dollar invested. But increasing the level under the program is estimated to return $1.89 for each additional dollar invested.[6]

[5] The farm program of 1956 was a combination of acreage allotments and price supports for basic crops with supplementary soil-bank features. The acreage reserve of the soil-bank part of the program was made available to farmers in June after most of the corn was planted. The final date for signing acreage-reserve contracts was July 27. Acreage adjustment was not required until August 31. Thus, low-yielding acres could be selected accurately for placement in the soil bank. The pattern of actual participation in the acreage reserve was influenced by the geographical pattern of spring rainfall in 1956. The conservation-reserve part of the Soil Bank Program was not made available until the fall of 1956, and participation was small.

[6] The return to marginal increments of fertilizer is estimated from the input–output data for rotations on Grundy–Haig soil (see tables 19 to 22). To obtain the return per additional dollar invested in fertilizer, the change in value of all products from a unit of rotation is divided by the change in the cost of fertilizer from a low to a medium rate of application. This yields an "average marginal return" over the range of fertilizer inputs from "low" to "medium." The increase in the return to fertilizer investment under the program results from the higher price received for corn when it is sealed rather than sold in the free market.

TABLE 1.—OPTIMUM CASH-GRAIN FARMING SYSTEM: *160-acre owner-operated moderately eroded farm, not in compliance and in compliance with a 1956-type Soil Bank Program*

Item	Unit	Not in compliance	Method of compliance [1]			
			I	II	III	IV
Rotation and soil class: [2]						
C-Sb-C-O-M, A	Acre	44	44	44	44	44
C-O-M-M, B	do	11		11		
C-O-M-M-M-M, B	do		11			11
C-O-M-M, C	do	54			[3] 51	
C-O-M-M-M-M, C	do		38	40		45
Acreage reserve	do		6	5	14	5
Conservation reserve	do		10	9		
Permanent pasture	do	37	37	37	37	41
Livestock:						
Poultry	Number	100	100	100	100	100
Dairy cows	do	5	5	5	5	5
Corn acreage	Acre	34	26	27	18	27
Corn production	Bushel	1, 653	1, 357	1, 586	1, 030	1, 410
Grain sold	do	1, 741	1, 326	1, 600	1, 570	1, 403
Grain fed	do	304	304	304	304	304
Forage production (hay equivalent)	Ton	109	94	111	94	107
Cash income	Dollar	2, 160	2, 513	2, 709	2, 751	2, 451
Operating capital	do	2, 515	2, 297	2, 351	2, 461	2, 307
Investment capital	do	17, 690	17, 690	17, 690	17, 690	17, 690
Labor used	Hour	1, 345	1, 282	1, 293	1, 316	1, 271

[1] Explanation of methods of compliance: I—No change in practices used on the farm; II—the rate of fertilizer use was increased from the low to the medium level described in tables 19 to 22; III—no change in production practices with sorghums added to cropping system; IV—same as I without a conservation reserve.

[2] C = Corn; O = Oats; Sb = Soybeans; M = Meadow. Class A land—Grundy-Haig silt loam of 0 to 8 percent slope; Class B land—Shelby silt loam of 4 to 7 percent slope; Class C land—Shelby silt loam of 8 to 12 percent slope.

[3] Sorghums were substituted for corn to make a rotation of sorghum, oats, meadow, meadow.

Likewise, sorghums substituted for corn normally return $5.14 per acre, but under the program they would return $12.44.[7]

With no change in practices, the cropping system would become less intensive in the optimum plans for compliance. The nearly level Grundy and Haig (class A) soils would remain in a corn–soybeans–corn–oats–meadow rotation. All acres diverted from corn are on Shelby (class C) soil with 4 to 12 percent slope. This change would decrease soil erosion on the steeper land. From the standpoint of production control, however, the program would be more effective if the higher yielding land were taken out of production. Most of the potential reduction in output of corn from decreasing the acreage could be regained by increasing the rate of fertilization and improving management on the remaining acres. With no change in production practices, the output of corn would be reduced by 18 percent while the acreage of corn would be reduced by 24 percent.

Operating capital no longer needed for crop expenses would now be available for expanding livestock enterprises. Because of added forage production, the capital not needed for crops, poultry, and dairy would return more in beef cows than it would in hogs. The amount of capital, however, would be large enough to provide for only one beef cow. As the operator would probably consider this investment to be trivial, it was not included in the plan.

Tenant-operated cash–grain farms.—Optimum plans for tenant-operated cash–grain farms are given in table 2. These farms made up only a small proportion of all farms in the area. They are presented, however, because tenants and landlords often have different and conflicting interests in the extent of participation.

Both tenant and landlord would benefit by compliance. The landlord would maximize his net return by planting as much corn as possible to get the support price. The rent per acre from corn on the poorest ground is $27.36 compared with $14.49 for acreage reserve. As operation of the steeper

[7] The value of substituting grain sorghum is estimated from the linear programing matrix. In the optimum solution, the positive shadow price under a rotation containing corn instead of grain sorghum gives the gain in income from substituting the last acre of grain sorghum. The substitution has a high value in the program because additional land can be placed in the acreage reserve when grain sorghum is used to reduce the acreage of corn below the allotment.

TABLE 2.—OPTIMUM CASH-GRAIN FARMING SYSTEM: *240-acre tenant-operated moderately eroded farm, not in compliance and in compliance with a 1956-type Soil Bank Program*

Item	Unit	Not in compliance	Method of compliance [1]			
			I	II	III	IV
Rotation and soil class: [2]						
C–Sb–C–O–M, A	Acre	62	62	62	62	62
C–C–O–M, B	do	16				
C–O–M–M, B	do				16	16
C–C–O–M, C	do	76				
C–O–M–M, C	do				52	60
Acreage reserve	do		35	35	18. 2	16
Conservation reserve	do		34	34	5. 8	0
Permanent pasture	do	69	92	92	69	69
Livestock:						
Poultry	Number	100	100	100	100	100
Dairy cows	do	5	5	5	5	5
Corn acreage	Acre	71	25	25	42	44
Corn production	Bushel	2, 732	1, 451	1, 674	2, 105	2, 181
Grain sold	do	3, 379	1, 333	1, 587	2, 440	2, 516
Grain fed	do	304	304	304	304	304
Forage production (hay equivalent)	Ton	116	96	101	116	123
Cash income:						
Tenant [3]	Dollar	1, 165	1, 690	1, 937	1, 535	1, 495
Landlord [4]	do	1, 802	2, 125	2, 274	2, 305	2, 324
Farm [5]	do	2, 967	3, 815	4, 211	3, 840	3, 819
Operating capital:						
Tenant	do	2, 614	2, 054	2, 098	2, 287	2, 303
Landlord	do	574	238	282	356	366
Labor used, tenant	Hour	1, 705	1, 705	1, 293	1, 487	1, 493

[1] See table 1, footnote 1, for explanation of methods of compliance.
[2] See table 1, footnote 2, for explanation of symbols.
[3] Tenant cash income=gross income−annual expense−cash rent or permanent pasture.
[4] Landlord cash income=crop income+cash rent−crop expense−taxes.
[5] Farm cash income=tenant cash income+landlord cash income.

ground is not very profitable for the tenant, he would gain most by putting this land in the soil bank.

These differences in method of compliance on tenant-operated cash-grain farms would need to be resolved through bargaining by tenant and landlord. As there is a scarcity of farms in the area, landlords would probably be in the stronger bargaining position and could often specify the method of compliance.

Comparison of Optimum Farming Systems on Livestock Farms

Livestock farms, which make up 57 percent of all farms in the area, comprise the largest group of farms. Normally, these farmers process through livestock all grain and hay they produce. The compliance rate among livestock farmers under corn-allotment programs was low because, with medium to good efficiency, these farmers can obtain returns greater than the loan rate by processing grain through livestock.

With the opportunity to seal their own corn at $1.44 per bushel and to buy free corn at $1.30 (the cost to farmers in 1956), farmers would find it most profitable to buy and feed free corn. The plans show that it would be profitable to seal corn produced on the farm. They show also that it would be profitable to buy a limited amount of free corn to maintain a reduced hog enterprise and to supplement forage in beef-cattle enterprises. But livestock farmers who wanted to maintain a hog enterprise would find it more profitable not to comply with the program and to grow more corn. This is because of the smaller processing margin for purchased than for farm-raised corn. The handling charge of 10 cents a bushel decreases the profitability of hogs.

An *owner-operated livestock farm*, with no change in fertilization practices, returns a cash income of $3,465 without the program and $3,419 with the program, or an actual loss of $46 from compliance (table 3). It is probable that the reduced risk, the desire to cooperate with a government program, and above-average opportunities for compliance [8] would cause some livestock farmers to comply.

[8] As the estimated net income from compliance approximates the income from noncompliance, other factors that

TABLE 3.—OPTIMUM LIVESTOCK FARMING SYSTEM: *160-acre owner-operated moderately eroded farm, not in compliance and in compliance with a 1956-type Soil Bank Program*

Item	Unit	Not in compliance	Method of compliance [1]			
			I	II	III	IV
Rotation and soil class:[2]						
C–Sb–C–O–M, A	Acre	44	44	44	44	40
C–Sb–C–O–M–M, A	do					4
C–O–M–M, B	do	11	11	11		
C–O–M–M–M–M, B	do					11
C–O–M–M, C	do	54			[3] 52	
C–O–M–M–M–M, C	do		40	40		49
Acreage reserve	do		5	5	13	5
Conservation reserve	do		9	9		
Permanent pasture	do	37	37	37	37	37
Livestock:						
Poultry	Number	100	100	100	100	100
Dairy cows	do	5	5	5	5	5
Beef cows	do	13	9	17	9	11
Fat calves	do		7		7	9
Hogs (litters)	do	15	5		2	1
Corn acreage	Acre	34	27	27	19	27
Corn production	Bushel	1, 653	1, 406	1, 619	1, 094	1, 398
Grain sold	do		1, 406	1, 522	1, 099	1, 398
Grain fed	do	2, 045	1, 131	409	982	920
Grain bought	do		849			617
Forage production (hay equivalent)	Ton	109	98	122	99	115
Cash income	Dollar	3, 465	3, 419	3, 794	3, 743	3, 414
Operating capital	do	6, 421	6, 421	5, 973	5, 465	6, 421
Investment capital	do	17, 690	17, 690	17, 690	17, 690	17, 690
Labor used	Hour	1, 975	1, 743	1, 552	1, 636	1, 683

[1] See table 1, footnote 1, for explanation of methods of compliance.
[2] See table 1, footnote 2, for explanation of symbols.
[3] Sorghums were substituted for corn to make a rotation of sorghum, oats, meadow, meadow.

If the rate of fertilization is increased, a livestock farmer can increase yields per acre enough under the program to increase cash income $329 above the estimated income for noncompliance. (This comparison supposes that the increase in rate of fertilization would not be made without participation.) Sizable adjustments would be necessary, however, to increase income this much through adding more fertilizer. The hog enterprise would be dropped and the beef–cow herd expanded to utilize the increased forage. Capital would be transferred from hogs to beef.

But the estimated increase in cash income from the shift in livestock would be less than $25. The difference in income is not large enough to serve as a criterion of choice between the two systems. The decision on the livestock system thus rests on such criteria as risk, work, personal preference, special abilities, or diversification.

Sorghums harvested for grain would be a profitable alternative for a livestock farmer who is entering the program. As there is no restriction on acreage of sorghums, some of the corn allotment could be placed profitably in the acreage reserve and a supply of feed grains could be obtained by producing sorghums. Total soil-depleting acreage, including that in sorghums and acreage reserve, would then be greater than the farm soilbank base. Thus the opportunity to participate in the conservation reserve would be eliminated.

Tenant-operated livestock farms.—The effect of a 1956-type program on the optimum plans for a tenant-operated livestock farm (table 4) would be similar to that on an owner-operated livestock farm. Total cash income (landlord and tenant shares together) would be increased by $12 through compliance with the program. Considerable reorganization would be needed to obtain even this small gain. The percentage of class A land in forage would be increased from 20 to 33 percent. On class C land, the change would be from 50 to 67 percent. Hogs would be eliminated; number of beef cows, reduced. Calves would be

influence farmers' decisions must be recognized. The income from compliance is more certain than that from noncompliance. Therefore, it may be of more subjective value to some farmers. Cooperation with any program is distasteful to some farmers. Others consider it a moral obligation to do the "right thing" and cooperate with the program provided for them. Those farmers whose allotments are relatively large because of past history may be said to have above-average incentives to comply. Compliance will be profitable for some farmers, even though it is not profitable for the average situation.

fed out rather than sold as feeders as in the optimum plan without participation.

If the fertilizer level were increased under the program, a different effect would be obtained. Cow numbers would be increased rather than decreased (as compared with the basic plan). Corn production would be reduced by only 12 percent as compared with 25 percent under the compliance plan with fertilization rates unchanged. Income for both tenant and landlord would be increased. The total increase in income would amount to $177.

The landlord might object to plan I, which would maximize the tenant's profit. The plan that would be optimum for the landlord (plan III) would produce more corn and soybeans and less hay and pasture. The landlord's income would be increased by $73 as compared with nonparticipation, while the tenant's income would be decreased by $185. If the optimum plan for the landlord were used, the tenant would keep fewer cows. The landlord would get only $31 more cash income under the plan that would maximize his profit than he would get under the plan that would maximize profit for the tenant. This difference in income would not be large enough to cause conflict between many landlords and tenants.

TABLE 4.—OPTIMUM LIVESTOCK FARMING SYSTEM: *240-acre tenant-operated moderately eroded farm, not in compliance and in compliance with a 1956-type Soil Bank Program*

Item	Unit	Not in compliance	Method of compliance [1]		
			I	II	III
Rotation and soil class: [2]					
C–Sb–C–O–M, A	Acre	62		49.5	62
C–Sb–C–O–M–M, A	do		62	12.5	
C–O–M–M, B	do	16	16	16	16
C–O–M–M–M–M, C	do		56	37	31
C–O–M–M, C	do	76			
Acreage reserve	do		6	6	6
Conservation reserve	do				10.6
Permanent pasture	do	69	89	102	97
Livestock:					
Poultry	Number	100	100	100	100
Dairy cows	do	5	5	5	5
Beef cows	do	24	20	29	16
Fat calves	do		16		13
Hogs (litters)	do	9			
Corn acreage	Acre	48	34	34	34
Corn production	Bushel	2,302	1,742	2,043	1,818
Grain sold	do	1,374	1,894	1,049	1,854
Grain fed	do	1,498	1,268	494	1,097
Grain bought	do		1,039		841
Forage production (hay equivalent)	Ton	167	179	187	195
Cash income:					
Tenant	Dollar	2,887	2,857	3,041	2,702
Landlord	do	2,021	2,063	2,044	2,094
Farm	do	4,908	4,920	5,085	4,796
Operating capital:					
Tenant	do	8,128	8,460	8,128	6,984
Landlord	do	400	280	341	288
Labor used, tenant	Hour	2,155	2,137	1,859	2,068

[1] See table 1, footnote 1, for explanation of methods of compliance.
[2] See table 1, footnote 2, for explanation of symbols.

A SOIL BANK FOR CORN-BASE-ACREAGE TYPE OF PROGRAM

The Base Acreage Program for Corn, which was rejected by farmers for the 1957 crop-year, provided a national base acreage of 51 million acres for the commercial corn area.[9] No acreage allotments were to be in effect. The national average price-support level for corn set by the Secretary of Agriculture was $1.31 per bushel. The program granted the Secretary the power in future years to set the support price for corn at such

[9] On December 11, 1956, about 400,000 corn farmers voted in a corn referendum to determine the type of corn program they should have for 1957 and later years. Of these farmers, 61 3/10 percent preferred a "Corn Base Acreage Program" over the "Acreage-Allotment Program." The terms of the referendum as set by the Congress stated that the Corn Base Acreage Program should not go into effect unless 66⅔ percent of the farmers voting favored the program.

levels as "will assist producers in marketing corn in the normal channels of trade." To qualify for corn price support, producers were not to exceed their share of the national base acreage for corn.

In addition, farmers were required to place—

(a) 15 percent of the farm corn base in the acreage reserve, thus reducing the acreage of corn below the base acreage, or

(b) an amount of other cropland equal to 15 percent of the corn base in the conservation reserve, in which case the acreage of corn could be equal to the corn base, or

(c) an amount equal to at least 15 percent of the farm corn base in some combination of acreage reserve and conservation reserve, thus reducing the acreage of corn below the corn base but not necessarily 15 percent below.

The estimated effects of a program of this kind on livestock and cash-grain farms are presented in the next two subsections.

Comparison of Optimum Farming Systems on Cash-Grain Farms

The optimum plans for cash-grain farms in compliance with a soil-bank base-acreage-for-corn type of program indicate that a relatively large acreage in the soil bank is profitable. The program requirement placing 15 percent of the corn base in the conservation reserve or in the acreage reserve is exceeded on both the tenant- and the owner-operated farms. With the support price for corn in southern Iowa at $1.25 per bushel, compliance with the program would be more profitable than noncompliance. Without the payment for acreage reserve, a cash-grain farmer would lose money by complying with a corn-base-acreage type of program.

Optimum plans for a tenant-operated cash-grain farm in compliance with a base-acreage-for-corn type of program are presented in table 5. The combination of enterprises for the tenant-operated farm is the same as that under the 1956-type program. The income is lower than for the 1956-type program because the support price for corn is $1.25 rather than $1.44. However, both tenant and landlord would have higher cash incomes through compliance with the base-acreage-for-corn program than they would have through noncompliance, to the extent of $424 and $185, respectively.

On an owner-operated cash-grain farm, compliance would increase net cash income by $265. Either of two alternative plans of compliance provides a cash income of about $2,425 (table 5).

TABLE 5.—OPTIMUM CASH-GRAIN FARMING SYSTEM: *240-acre tenant-operated and 160-acre owner-operated moderately eroded farms not in compliance and in compliance with a corn-base-acreage type of program*

Item	Unit	Tenant-operated		Owner-operated		
		Not in compliance	In compliance	Not in compliance	In compliance I [1]	In compliance II [1]
Rotation and soil class: [2]						
C-Sb-C-O-M, A	Acre	62	62	44	44	44
C-C-O-M, B	do	16				
C-O-M-M, B	do			11		
C-O-M-M-M-M, B	do				11	11
C-C-O-M, C	do	76				
C-O-M-M, C	do			54		
C-O-M-M-M-M, C	do				38	
Acreage reserve	do		35		6	13
Conservation reserve	do		34		10	16
Permanent pasture	do	69	92	37	37	62
Livestock:						
Poultry	Number	100	100	100	100	100
Dairy cows	do	5	5	5	5	5
Corn acreage	Acre	71	25	34	26	19
Corn production	Bushel	2,732	1,451	1,653	1,357	1,107
Grain sold	do	3,379	1,333	1,741	1,336	968
Grain fed	do	304	304	304	304	304
Forage production (hay equivalent)	Ton	116	96	109	106	87
Cash income:						
Tenant	Dollar	1,165	1,589			
Landlord	do	1,802	1,987			
Farm	do	2,967	3,576	2,160	2,425	2,430
Operating capital:						
Tenant or owner	do	2,614	2,054	2,515	2,104	2,104
Landlord	do	574	238			
Labor used	Hour	1,705	1,293	1,345	1,282	1,234

[1] Alternative plans of compliance. [2] See table 1, footnote 2, for explanation of symbols.

One alternative plan moves the poorest land from a rotation of corn, oats, and 2 years of meadow to corn, oats, and 4 years of meadow. The other plan moves grain off the poorest land, places the land formerly in grain in the soil bank, and shifts the meadow to permanent pasture. The support price for corn and soil-bank payments are in such relationship to each other that putting the poorer land in the soil bank or using it to produce corn are equal alternatives.

Comparison of Optimum Farming Systems on Livestock Farms

The optimum plans show that total income would be reduced by $394 on the tenant-operated livestock farm through compliance with a corn-base-acreage program (table 6). To keep the loss this low, hogs must be eliminated and the acreage of corn on the poorest land reduced by 46 percent. Participation in the soil bank would be met by placing the legal minimum of 6 acres (15 percent of the corn base) in the conservation reserve. No corn would be placed under loan at the rate of $1.25 per bushel, and no land would be put in the acreage reserve. The 6 acres placed in the conservation reserve would return to the tenant $4.20 per acre above the cost of establishing and maintaining a grass cover. This can be compared with the $5 to $11 return per acre the tenant could receive from these acres if they produced forage for his beef enterprise. Participation in the program also restricts production of feed grain, a valuable intermediate product. Compliance with a corn-base-acreage type of program would not be profitable for a tenant-operated livestock farmer in southern Iowa.

On an owner-operated livestock farm, cash income would be reduced $48 by compliance with a soil-bank base-acreage-for-corn type of program. However, little adjustment would be required. For example, the acreage of corn would need to be reduced by only 2 acres; production of forage would be nearly constant; and no corn would be sealed. With the prices used for the study reported, the typical livestock farmer receives about

TABLE 6.—OPTIMUM LIVESTOCK FARMING SYSTEM: *240-acre tenant-operated and 160-acre owner-operated moderately eroded farms not in compliance and in compliance with a corn-base-acreage program*

Item	Unit	Tenant-operated		Owner-operated	
		Not in compliance	In compliance	Not in compliance	In compliance
Rotation and soil class: [1]					
C-Sb-C-O-M, A	Acre	62		44	44
C-C-O-M-M, A	do		62		
C-O-M-M, B	do	16	16	11	11
C-O-M-M, C	do	76	41	54	35
C-O-M-M-M-M, C	do				14
Conservation reserve	do		6		5
Permanent pasture	do	69	98	37	37
Livestock:					
Poultry	Number	100	100	100	100
Dairy cows	do	5	5	5	5
Beef cows	do	24	21	13	9
Fat calves	do		16		7
Hogs (litters)	do	9		15	12
Corn acreage	Acre	48	39	34	32
Corn production	Bushel	2,302	1,998	1,653	1,565
Grain sold	do	1,374	1,164		
Grain fed	do	1,498	2,201	2,045	2,057
Forage production (hay equivalent)	Ton	167	184	109	105
Cash income:					
Tenant	Dollar	2,887	2,783		
Landlord	do	2,021	1,731		
Farm	do	4,908	4,514	3,465	3,417
Operating capital:					
Tenant or owner	do	8,128	7,283	6,421	6,421
Landlord	do	400	325		
Investment capital	do			17,690	17,690
Labor used	Hour	2,155	2,073	1,975	1,964

[1] See table 1, footnote 2, for explanation of symbols.

$1.40 for corn processed through livestock. Hence he would have little interest in sealing corn at $1.25 per bushel. The decision of owner-operator livestock farmers to comply with the program would be based on considerations other than profit.

A 1957-TYPE PROGRAM

The program for 1957 had a corn-acreage allotment, a soil-bank opportunity, and a support price for corn of $1.36 per bushel.[10] Participants in the acreage reserve were required to reduce the number of acres of corn planted below their allotments. To place land in the conservation reserve, participants had to reduce the total number of acres of soil-depleting crops; that is, the total of soil-depleting crops, acreage reserve, and conservation reserve had to be less than the farm soil-bank base.[11]

At the time farmers made their individual decisions as to actual compliance with the 1957 program, yield expectations for the 1957 season varied widely among areas and among farms within areas. Probably the greatest factor influencing these expectations was the previous year's rainfall and prospects for soil moisture at planting time. Thus the 1957 compliance rate was associated closely with the 1956 rainfall pattern. Farmers with low yield expectations leaned heavily on the soil bank as a source of income for 1957. Even though they could expect a lower income through compliance and a higher income for noncompliance under normal or average weather, many decided to reduce the risk and try for the more certain income under compliance in 1957. In the early spring of 1957, a very low profit or even a loss in 1957 seemed possible to farmers in some areas. Thus some farmers complied, even though the restrictions on corn acreages were severe. However, the weather in 1957 turned out to be favorable for corn, and many who complied were later unhappy with their contracts.

Also favoring compliance in 1957 was the opportunity to substitute sorghums for corn. Many of the farmers who made acreage-reserve contracts in 1957 made them for the entire allotment, reduced their acreages of oats and meadow, and planted about their normal corn acreages to sorghums. As sorghums yield better than corn in dry years, they thus increased expectations of a more normal supply of feed grains, and obtained added income assurance as well by placing land in the acreage reserve for Government payments.

The analysis of the effects of the 1957 program that follows represents a long-run appraisal. Hence, average weather and no uncertainty as to yield or price were assumed. For this reason, the resulting estimated long-run effects of the program differ considerably from the actual effects of the program in 1957.

Comparison of Optimum Farming Systems on Cash–Grain Farms

Cash–grain farmers complying with a 1957-type program would maximize profit by using their lands less intensively and supplementing their incomes by soil-bank payments. Compliance would reduce the total quantity of feed produced on the cash–grain farms by 20 to 40 percent. If cash–grain farmers substituted sorghums for corn, net cash income would be substantially higher through compliance; the acreages of land in intertilled crops would not change; and the total feed production would change little or none from the optimum plan without compliance (table 7).

On a tenant-operated cash–grain farm, income would be increased by $337 through compliance. However, the tenant would need to make an important shift in land use for compliance. All 92 acres of classes B and C land would be shifted from a corn–corn–oats–meadow rotation to 23 acres of permanent pasture, 18 acres of acreage reserve, and 51 acres of conservation reserve. As a result, production of corn would be cut from 2,732 to 1,451 bushels, or 47 percent. Hay would be reduced from 116 to 97 tons, or by 16 percent. A soil-bank payment of $1,048 would be realized by tenant and landlord together. This soil-bank payment would more than compensate the tenant for the income he would have had from 46 acres of corn and 23 acres of oats if he had not participated in the program. The payment would help to make compliance profitable and to obtain the 2,046-bushel reduction in grain produced on the farm.

On an owner-operated cash–grain farm, income would be reduced by $25, or from $2,160 to $2,135, by compliance with the 1957 program. As on the tenant farm, use of the better land would remain unchanged but the less productive land would be farmed less intensively. Twenty-two acres of the

[10] The minimum support price is given by law in the Agricultural Adjustment Act of 1949, and acreage allotments are given by schedule in the 1938 Domestic Allotment Act (*11, pp. 43, 151*).

[11] Farm soil-bank base is the average of the last 2 years' total acreage of intertilled and small-grain crops.

TABLE 7.—OPTIMUM CASH-GRAIN FARMING SYSTEM: *240-acre tenant-operated and 160-acre owner-operated moderately eroded farms not in compliance and in compliance with a 1957-type program*

Item	Unit	Tenant-operated		Owner-operated	
		Not in compliance	In compliance	Not in compliance	In compliance
Rotation and soil class: [1]					
C–Sb–C–O–M, A	Acre	62	62	44	44
C–C–O–M, B	do	16			
C–O–M–M, B	do			11	
C–O–M–M–M–M, B	do				11
C–C–O–M, C	do	76			
C–O–M–M, C	do			54	
C–O–M–M–M–M, C	do				20
Acreage reserve	do		18		
Conservation reserve	do		51		22
Permanent pasture	do	69	92	37	49
Livestock:					
Poultry	Number	100	100	100	100
Dairy cows	do	5	5	5	5
Corn acreage	Acre	71	25	34	23
Corn production	Bushel	2,732	1,451	1,653	1,243
Grain sold	do	3,379	1,333	1,741	1,162
Grain fed	do	304	304	304	304
Forage production (hay equivalent)	Ton	116	97	109	86
Cash income:					
Operator	Dollar	1,165	1,441		
Landlord	do	1,802	1,863		
Farm	do	2,967	3,304	2,160	2,135
Operating capital:					
Operator	do	2,614	2,106	2,515	2,238
Landlord	do	574	260		
Labor used	Hour	1,705	1,434	1,345	1,273

[1] See table 1, footnote 2, for explanation of symbols.

latter would be placed in the conservation reserve and 12 acres would go into permanent pasture. Only 5 acres of corn per year would be grown on the remaining 31 acres.

The income effect of the 1957 program would be influenced, of course, by the free market price for corn. If, for example, the price of corn in the noncompliance plan were reduced from $1.20 to $1.00 per bushel, the income under the optimum plan without compliance would be $1,812. Then the income of $2,135 under the 1957 program would be $323 higher than with noncompliance.

Comparison of Optimum Farming Systems on Livestock Farms

Livestock farmers would receive considerably more income by not complying with a 1957-type program in an average year. If they did comply, no land would be placed in the acreage reserve because of the direct competition with corn.

A tenant who operates a livestock farm under a crop-share–cash lease would forgo $502 in income by complying with a 1957-type program in a year of average weather (table 8). His landlord would lose $462. If they did comply, the tenant would prefer to let all the class C land revert to permanent pasture, or he would place as much of it as possible in the conservation reserve and put the rest in permanent pasture. His income would be approximately the same under either alternative. The landlord would obtain a higher rent from a corn–oats–meadow–meadow rotation than from a shift to permanent pasture or to the conservation reserve.

An owner who operates a livestock farm would forgo $378 in net income by complying with a 1957-type program in a year of average weather. His livestock program would change very little, but he would need to buy 527 bushels of corn. The cost of the corn and the value of the 10 tons of forage lost by participating would not be offset by the soil-bank payment of $220 for 22 acres of conservation reserve. The reduction in grain production would result mainly from a very low allotment. Reduction in forage production is the result of the conservation reserve.

TABLE 8.—OPTIMUM LIVESTOCK FARMING SYSTEM: *240-acre tenant-operated and 160-acre owner-operated moderately eroded farm not in compliance and in compliance with a 1957-type program*

Item	Unit	Tenant-operated		Owner-operated	
		Not in compliance	In compliance	Not in compliance	In compliance
Rotation and soil class: [1]					
C–Sb–C–O–M, A	Acre	62		44	15
C–Sb–C–O–M–M, A	do				29
C–C–O–M–M, A	do		62		
C–O–M–M, B	do	16	16	11	
C–O–M–M–M–M, B	do				11
C–O–M–M, C	do	76		54	
C–O–M–M–M–M, C	do				32
Acreage reserve	do				
Conservation reserve	do				22
Permanent pasture	do	69	145	37	37
Livestock:					
Poultry	Number	100	100	100	100
Dairy cows	do	5	5	5	5
Beef cows	do	24	20	13	9
Fat calves	do		16		7
Hogs (litters)	do	9		15	11
Corn acreage	Acre	48	29	34	23
Corn production	Bushel	2, 302	1, 618	1, 653	1, 205
Grain sold	do	1, 374	921		
Grain bought	do		316		527
Grain fed	do	1, 498	1, 292	2, 045	1, 976
Forage production (hay equivalent)	Ton	167	178	109	99
Cash income:					
Operator	Dollar	2, 887	2, 385		
Landlord	do	2, 021	1, 559		
Farm	do	4, 908	3, 944	3, 465	3, 087
Operating capital:					
Operator	do	8, 128	8, 388	6, 421	6, 421
Landlord	do	400	209		
Investment capital	do			17, 690	17, 690
Labor used	Hour	2, 155	2, 183	1, 975	1, 903

[1] See table 1, footnote 2, for explanation of symbols.

SUMMARY OF SELECTED EFFECTS OF THREE PROGRAMS

A 1956-type program, a soil-bank base-acreage-for-corn type program, and a 1957-type program were analyzed as to their effects on farm income, resource use, and production. The effects of each type of program were shown with *no change in production practices.* A brief digest of the effects is presented in tabular form in table 9. Some other effects of the programs are appraised in a succeeding section.

TABLE 9.—THREE PRODUCTION-CONTROL PROGRAMS: *Comparison of compliance and noncompliance with respect to net cash farm income, resource use, and output response, assuming no change in production techniques*

1956-TYPE PROGRAM

Farm income	Resource use	Volume and composition of output
Cash–grain farm income up 16% for owner-operated farm, 29% for tenant-operated farm. Livestock farm income down 1.3% for owner-operated farm, unchanged for tenant-operated farm.	Labor decreased on all farms. Capital decreased on cash–grain farms, constant on livestock farms. Land used less intensively on all farms if no change in kind of crop grown.	Corn production on cash–grain farms down 18% for owner-operated, 47% for tenant-operated. On livestock farms down 15% for owner-operated, 25% for tenant-operated. Pork production decreased, beef increased on livestock farms. Total meat production decreased.

TABLE 9.—THREE PRODUCTION-CONTROL PROGRAMS—Continued

Farm income	Resource use	Volume and composition of output
CORN-BASE ACREAGE PROGRAM		
Cash–grain farm income up 12% for owner-operated farm, up 21% for tenant-operated farm. Livestock farm income down 1.4% for owner-operated farm, down 8% for tenant-operated farm.	Labor decreased on cash–grain farms, about constant for livestock farms. Capital decreased on all farms except owner-operated livestock. Land used less intensively on all farms. Substantial amounts placed in soil bank on cash–grain farms.	Corn production on cash–grain farms down 18% for owner-operated, 47% for tenant-operated. On livestock farms, down 5% for owner-operated, 13% for tenant-operated. Pork production decreased, beef increased. Total meat production about constant.
1957-TYPE PROGRAM		
Cash–grain farm income down 1.2% for owner-operated farm, up 11% for tenant-operated farm. Livestock farm income down 11% for owner-operated farm, 20% for tenant-operated farm.	Labor decreased on cash–grain farms, constant on livestock farms. Capital decreased on cash–grain farms, constant on livestock farms. Land used less intensively on all farms. No land in acreage reserve except on tenant-operated cash–grain farms.	Corn production on cash–grain farms down 25% for owner-operated, 47% for tenant-operated. On livestock farms down 27% for owner-operated, 30% for tenant-operated. Pork production down, beef increased. Total meat production about constant.

SOME OTHER EFFECTS OF PROGRAMS

Changes in Production Techniques

Acreage allotments restrict the use of land, but corn yields per acre can be varied by capital and labor inputs. Thus, acreage allotments provide only limited control over production of corn. Labor and capital inputs can be used to apply larger amounts of fertilizer per acre remaining in corn and to increase control of weeds and insects. This recombination of factors in corn production becomes profitable when the use of land is restricted and the price of corn is supported above market levels. Even if capital and labor inputs per acre are not changed, a nonproportional reduction in corn output can be attained by diverting the poorer acres from corn. As corn is the highest profit crop in the area, ordinarily it would not be profitable to reduce production of corn in the same proportion as acreage in corn is reduced. Production of corn would be curtailed in proportion to the reduction in the acreage of corn only if no other factors were substituted for land and all land had the same yield per acre.

Acreage Response to the Conservation Reserve Part of a 1956-Type Program

The conservation reserve was included in the 1956-type program analyzed in the study reported, although it was not a part of the program that operated in 1956. To appraise the effect of including the conservation reserve, optimum adjustments to a 1956-type program without the conservation reserve were compared with optimum adjustments with the conservation reserve. The comparison is made with no change in production practices for a 160-acre owner-operated cash–grain farm and a 160-acre owner-operated livestock farm. (See tables 1 and 3; compare compliance methods I and IV.)

Inclusion of the conservation reserve affects income or grain production very little. Participation in the conservation reserve decreases production of forage. As forage limits the amount of beef produced, the optimum plan for the livestock farmer who participates in the conservation reserve includes fewer cattle and more hogs. On the livestock farm, the optimum acreage of grain would not be affected by availability of the conservation reserve, but a greater proportion of the acreage of grain would be on the better land. Some reduction in acreage of grain is made on the cash–grain farm. Less adjustment in the rotation would be needed in complying with the 1956 program when the conservation reserve is available.

Cash–grain farmers may have more interest in the conservation reserve than is indicated by the small increase in net income. Considerable reduction in risk is obtained by placing steep erodible

land in the conservation reserve. Farmers do not like to cultivate the Shelby soil (class C land). It is difficult to till and erodes badly, and the profit from cultivation is variable and sometimes negative. If the entire 54 acres of class C land on the cash–grain farm were to be diverted from rotation to permanent pasture, acreage reserve, and conservation reserve, the cash income would be only $10 less. Many farmers may prefer to have the land in conservation reserve. They can then obtain financial help in establishing the seeding, and they will receive a guaranteed income.

Participation in Conservation Reserve at Various Levels of Payment

Programing techniques were used in calculating the amount of land a typical farmer could profitably place in the conservation reserve at different payment levels. A normative supply schedule was constructed for an individual farm by varying the conservation-reserve payment from 0 to $35 while holding all other prices constant. As the payment increases, changes in the farm organization are induced that allow a larger acreage to be placed in the conservation reserve. The acreages of land placed in the conservation reserve on a livestock and on a cash–grain farm at various payment levels, with the restriction that profit be maximized at each level, are as follows:

Type of farm and range of payments per acre	Acreage in conservation reserve
	Acres
Livestock farm:	
$0 to $7.60	0
$7.60 to $11.42	3. 4
$11.42 to $24.95	8. 8
$24.95 to $29.23	10. 2
$29.23 to $34.73	16. 6
$34.73 to $35.00	22. 1
Cash–grain farm:	
$0 to $2.13	3. 6
$2.13 to $7.05	8. 8
$7.05 to $10.92	10. 2
$10.92 to $13.74	16. 4
$13.74 to $29.94	18. 3
$29.94 to $32.27	32. 6
$32.27 to $35.00	41. 5

The linear programing method used may overestimate to some extent the payment needed to obtain a given level of participation. No account is taken of opportunities to employ labor and capital outside the farm or of the value to the farmer of having a certain income from the conservation-reserve payments rather than an uncertain income from crops. An additional source of overestimation of payments could come from the low yields assigned to land taken from regular rotation and placed permanently in pasture. Land held permanently in pasture yields considerably less than rotation meadow, which is renovated and reseeded periodically. The drop in yields would not be experienced, however, until some time after the initial change in the cropping program. To the extent that the yields used underestimate actual forage production during the first years after adjustment, they overestimate the cost to the farmer of changing his cropping program. Therefore, they overestimate the level of payment necessary to gain his participation in the conservation reserve.

Three important relationships are shown in the above tabulation: (1) At higher conservation-reserve payments, it would be profitable for both cash–grain and livestock farmers to offer larger acreages of land; (2) at a given payment level, more land would be offered by cash–grain than by livestock farmers; and, (3) cash–grain farmers would be expected to be more responsive than livestock farmers to changes in payment level.

Higher payment levels would be necessary to make any considerable shift of acreage to the conservation reserve profitable for livestock farmers. Participation in the conservation reserve causes a loss of forage production, which, in turn, curtails beef production. Hence, a higher rate of payment on conservation reserve is needed to compensate for the loss of earnings on resources formerly used by livestock farmers in producing beef.

Values of Program Allotments and Bases

The income of an individual farmer who complies with an acreage-control program is usually increased by additional acres of allotment or soil-bank base. If returns per acre from the use of land that is restricted is greater than returns from other uses, an additional acre of allotment (or base) would increase total returns from the farm.

The values presented in table 10 [12] are the estimated changes in net cash farm income that would result from a one-unit change in the specified acreage restriction. The valuations are based on analysis of a 1956-type program.

The corn allotment is not fully utilized on owner-operated cash–grain farms because the soil bank is a more profitable use than any rotation for part of the poorer land. With some acres of allotment already idle, additional acres of allotment are of no value. In contrast, each acre of the soil-bank corn base is worth $21.34 and each

[12] These values are the shadow prices from the profit function or dual of the linear-programing optimum solution.

acre of the farm soil bank is worth $7.81. This is because these bases limit the amount of land placed in the acreage reserve and the conservation reserve, respectively. Cash–grain farmers would receive a larger cash income if it were possible to increase participation in the conservation reserve without reducing acreages of corn, oats, or soybeans. They could also increase income by further participation in the acreage reserve without reducing the acreage of corn. As an additional unit of farm soil-bank base or soil-bank corn base would permit one of these changes and increase income, additional units have value. The value depends upon the difference between the return per acre for the crop or soil-bank activity that could be expanded and the return from the crop that would be reduced. The return from an acre of forage is higher on livestock than on cash–grain farms. Thus the gain on livestock farms from increasing the conservation-reserve acreage and decreasing the acreage of forage would be smaller than on cash–grain farms. Obviously, also, the value of an additional acre of farm soil-bank base, which makes participation in the conservation reserve possible, is lower on livestock farms.

The size of the acreage restrictions differs among farms because of variations in the historical cropping pattern. Farms with relatively large allotments and bases have higher earning capacities and higher market values if quality of land, location value, weather, and other factors are similar. If a program of the 1956 type were continued indefinitely, the influence of abnormally large or abnormally small allotments on the earning capacity of individual farms would be reflected in the value of the land in the farms.

TABLE 10.—*Value of an additional acre of allotment or base, by specified acreage restriction, southern Iowa*

Classification of farm	Restriction		
	Corn allotment	Soil-bank corn base	Farm soil-bank base
	Dollars	*Dollars*	*Dollars*
Owner-operated:			
Cash–grain	0	21. 34	7. 81
Livestock	15. 15	20. 55	1. 71
Tenant-operated:			
Cash–grain:			
To the tenant	0	11. 27	3. 15
To the landlord	0	9. 26	1. 23
Livestock:			
To the tenant	7. 87	11. 13	0
To the landlord	6. 66	0	0

Soil Erosion and a 1956-Type Program

In the Declaration of Policy section of both the Domestic Allotment Act of 1938 and the Soil Bank Act of 1956, conservation of natural resources is listed as one of the goals of farm programs. In the Soil Bank Act of 1956, prevention of soil erosion is directly provided for by the conservation reserve. Some estimates of the potential ability of a 1956-type program to change the level of soil erosion on a 160-acre owner-operated livestock farm are presented in table 11. These estimates of soil loss were made from the production plans in table 3 by using Browning's factors for soil erosion (7).

The crop rotation on Shelby silt loam with 8 to 12 percent slope (class C) would change from corn, oats, and 2 years of meadow in the basic situation to corn, oats, and 4 years of meadow when complying with a 1956-type program. Lengthening the rotation and including more grass would reduce the average soil loss per acre. This shift would reduce soil loss on the class C land from 14.12 tons per acre per year to 9.49 tons if no mechanical practices are used. However, a loss of 9.49 tons per year is well above the permissible level of the 4 tons recommended by the Soil Conservation Service. The 4-ton limit could be met only by using terraces. More soil could be saved by using contouring without changing rotations than by reducing the acreage of corn and leaving the level of mechanical practices unchanged.

Optimum plans for an owner-operated livestock farm show no change in rotations on classes A and

TABLE 11.—OWNER-OPERATED LIVESTOCK FARM: *Estimated annual soil loss per acre through erosion, southern Iowa*

Erosion-control measures	Grade of land			
	Class A	Class B	Class C	Farm average
	Tons	*Tons*	*Tons*	*Tons*
Without program:				
No mechanical practices	13. 76	5. 67	14. 12	13. 12
Contouring	6. 88	2. 84	8. 47	7. 26
Terracing	1. 38	. 57	1. 68	1. 43
With program:				
No mechanical practices	13. 76	5. 67	9. 49	10. 83
Contouring	6. 88	2. 84	5. 69	5. 88
Terracing	1. 38	. 57	1. 13	1. 17

B land in complying with a 1956-type program. Therefore, the program would not affect the annual soil loss per acre on the most productive land, which is presently operated with no mechanical erosion-control practices. This soil loss could be reduced by 90 percent, however, through the use of terraces. But adoption of mechanical practices is not a condition to compliance, and no increased incentive is offered for use of mechanical erosion-control practices on farms whose operators comply with a 1956-type program.

The degree to which a farm is eroded in the Shelby–Grundy–Haig soil area greatly affects its productivity, response to fertilizer, and the profit-maximizing plans for compliance with any of the programs. Table 12 presents some of the effects of erosion on the productivity of Shelby silt loam in southern Iowa.

TABLE 12.—COSTS AND RETURNS PER ROTATION: *Crops in a corn–oats–meadow–meadow rotation on Shelby silt loam with 8- to 12-percent slope, by degree of erosion and level of fertilization, southern Iowa* [1]

Item	Unit	Moderately eroded land with level of fertilizer—		Severely eroded land with level of fertilizer—	
		Low	Medium	Low	Medium
Grain in corn equivalent per rotation	Bushel	54	62. 5	40	53
Forage per rotation	Ton	3. 8	5. 0	2. 6	4. 6
Total annual cost per rotation	Dollar	33. 78	45. 90	35. 04	46. 73
Cost of fertilizer per rotation	do	8. 35	20. 25	9. 85	21. 30
Net returns for all grains and hay per rotation [2]	do	69. 02	79. 10	38. 96	62. 87
Net returns for grain crops only per rotation	do	31. 02	29. 10	12. 96	16. 87

[1] Data selected from tables 21 and 22. See C–O–M–M columns under Shelby soil 8- to 12-percent slope and under severely eroded phases of classes B and C land.

[2] Based on $1.20 per bushel for corn equivalents and $10 per ton for hay equivalents less annual costs.

Crop yields are about 25 percent lower on severely eroded than on moderately eroded Shelby soils. Crop yields can be maintained as the soil changes from moderately to severely eroded by using additional fertilizer. However, the cost of production would be increased by 40 percent. The necessity of using more fertilizer on severely eroded land would reduce net returns to capital, labor, and land used in production of grain by 50 percent on the severely eroded compared with the moderately eroded soil. Thus the value to the farm of the severely eroded Shelby soil would be about half the value of the moderately eroded Shelby soil.[13]

Forage crops on eroded Shelby silt loam respond to fertilizer. The amount of fertilizer that will produce grain yields on severely eroded Shelby silt loam that are equal to the average yields on moderately eroded Shelby silt loam will increase the yields of hay. Hay is a better alternative relative to grain on severely eroded than on moderately eroded Shelby soil.

Effects of Varying the Corn Support Price of the 1956-type Program

The corn loan rate for the 1956 program was set at $1.44 per bushel for southern Iowa. The effect of alternative loan rates for corn on optimum plans differs among farms. Crop-share tenant farmers have high production costs relative to the value of their share of the crop. Thus, they would be more responsive than cash-rent tenants or owner-operators to changes in the corn price. Those who grow corn on poor land with production costs about equal to the value of the corn produced would be most responsive to changes in the price of corn.

No change in the optimum plan for an owner-operated cash-grain farm in compliance with the 1956-type program would occur until the support price was lowered to $1.27 per bushel. As the support price was lowered to $1.27 per bushel, the income would fall but the same farm organization would maximize profit. If the corn support price were below $1.27 per bushel, it would be most profitable to remove the class C land from production and to place as much as possible in the soil bank and allow the rest to revert to permanent pasture. If the corn support price were less than

[13] Valuation by appraisal is the capitalization of the average net return to land at an appropriate rate of interest.

$1.25 per bushel, the class B land should be placed in the soil bank and permanent pasture. These plans are for farmers who do not consider substituting alternative crops or varying the rate of fertilization.

The optimum plan for a tenant cash–grain farmer in compliance with a 1956-type program shows no corn on classes B and C land. At $1.44 per bushel, the tenant cash–grain farmer finds it most profitable to grow less than his allotted acreage of corn to increase his acreage in the soil bank. If the price of corn were less than $1 per bushel, the tenant would further reduce his corn acreage. If the support price were above $1.80 per bushel, he would find it profitable to remove his classes B and C land from the soil bank and permanent pasture and to plant it to a corn–oats–meadow–meadow rotation.

An owner-operator livestock farmer in compliance with the 1956 program would not change his cropping plan with changes in the support price. But if the support level for corn were reduced 4 cents to $1.40 per bushel, he would find it profitable to alter his livestock program. At support prices below $1.40 per bushel, an owner-operator livestock farmer who complied with the program would maximize profit by feeding the corn produced on the farm to hogs rather than sealing it. However, at support levels below $1.44 per bushel, the owner-operator livestock farmer would have a larger income by not participating in the program if livestock prices were at the levels used in this report.

The optimum plans for tenant livestock farmers in compliance with a 1956-type program would be adjusted to changes in the support price of corn in the same way as those of the owner livestock farmer. A tenant livestock farmer would lose money by participating in a 1956-type program with the support price below $1.44 per bushel.

Effects of Programs on the Returns to Resources Used

Many factors contribute to the allocation of resources between agriculture and industry and between alternative uses on the farm, but earnings of marginal units of resources in each occupation is one of the main factors. Earnings of capital and land on typical 160-acre owner-operated farms complying and on those not complying with each of three alternative programs studied are presented in table 13. The earnings of capital and land on typical farms of various sizes not in compliance and those in compliance with a 1956-type program are presented in table 14.

TABLE 13.—ESTIMATED MARGINAL EARNINGS OF CAPITAL AND CROPLAND: *160-acre owner-operated farm not in compliance and in compliance with each of three production-control programs* [1]

Item	Unit	Cash–grain		Livestock	
		Not in compliance	In compliance	Not in compliance	In compliance
1956-TYPE PROGRAM					
Return to capital	Percent	39. 3	31. 9	30. 3	7. 6
Return to land per acre	Dollar	11. 65	17. 59	14. 31	27. 76
Estimated valuation per acre [2]	do	29. 64	55. 14	47. 23	365. 26
CORN-BASE-ACREAGE PROGRAM					
Return to capital	Percent	39. 3	31. 2	30. 3	7. 6
Return to land per acre	Dollar	11. 65	17. 69	14. 31	29. 76
Estimated valuation per acre [2]	do	29. 64	56. 70	47. 23	391. 58
1957-TYPE PROGRAM					
Return to capital	Percent	39. 3	30. 5	30. 3	7. 6
Return to land per acre	Dollar	11. 65	16. 82	14. 31	28. 24
Estimated valuation per acre [2]	do	29. 64	55. 15	47. 23	371. 58

[1] No change in production practices used in compliance plans.

[2] The value of land is estimated by capitalization of the estimated stream of earnings in perpetuity.

$$\text{Value of land} = \frac{\text{Return to cropland}}{\text{Return to capital}}$$

TABLE 14.—ESTIMATED MARGINAL EARNINGS OF CAPITAL AND LABOR: *Three farm situations not in compliance and in compliance with a 1956-type program*

Item	Unit	Cash–grain		Livestock	
		Not in compliance	In compliance	Not in compliance	In compliance
160-ACRE OWNER-OPERATED FARM [1]					
Return to capital	Percent	39. 3	31. 9	30. 3	7. 6
Return to land per acre	Dollar	11. 65	17. 59	14. 31	27. 76
Estimated valuation per acre [2]	do	29. 64	55. 14	47. 23	365. 26
160-ACRE OWNER-OPERATED FARM [3]					
Return to capital	Percent	39. 3	31. 1	30. 3	20. 2
Return to land per acre	Dollar	11. 65	18. 98	14. 31	21. 82
Estimated valuation per acre [2]	do	29. 64	61. 03	47. 23	108. 02
400-ACRE OWNER-OPERATED FARM [3]					
Return to capital	Percent	31. 1	30. 2	29. 2	20. 2
Return to land per acre	Dollar	11. 40	14. 97	17. 11	19. 24
Estimated valuation per acre [2]	do	36. 66	49. 57	58. 60	95. 25

[1] No change in fertilization rate for compliance plans.

[2] The value of land is estimated by capitalization of the estimated stream of earnings in perpetuity.

$$\text{Value of land} = \frac{\text{Return to cropland}}{\text{Return to capital}}$$

[3] Increased rate of fertilization used in compliance plans with production-control programs.

The values in tables 13 and 14 [14] are the changes in net revenue that would result from a one-unit change in the quantity available of the respective limited resource. If more units of resources than were used were available, the addition or subtraction of one unit would not change the net revenue. The effect of each of the programs on returns to capital and land was estimated by comparing the net returns to each under both compliance and noncompliance situations.

The earnings of labor employed in agriculture often depend on the opportunities to utilize fully the labor available. Opportunities to utilize profitably the labor available are limited by the amounts of land and capital that are combined with labor in the operation of farms. On cash–grain farms, compliance with any of the programs studied would reduce the opportunities to utilize labor in the present set of resources. Earnings of labor would be increased by expanding the size of the farm or by incorporating more capital into the farm business through increasing livestock enterprises. Such adjustments would not be facilitated directly by any of the programs.

On all farms studied, the return to capital would be decreased by compliance with any of the programs. With no changes in production practices, the amount of capital that could be invested in crop production—the highest profit alternative—would be reduced. Cash–grain farmers who would not expand livestock production, would be unable to utilize all available capital. Livestock farmers would be able to utilize all capital available, but those who complied would need to use a greater proportion of the capital in livestock production, where it returns less than in crop production. Thus, on both cash–grain and livestock farms, both average and marginal returns to capital would be reduced.

The return to capital under compliance may be decreased less if production techniques are changed than if they are not changed. Additional

[14] The values are obtained from the linear programing matrix for the optimum farm plan. They are the deltas in the profit function associated with the resource nonuse vectors. They are a measure of the value to the firm of marginal units of the resources. However, they cannot be rigidly defined as marginal-value productivities because the necessary condition of *ceteris paribus*, that is, holding constant the quantity of all other factors used, is not fulfilled. Only the limited resources are necessarily held constant as the return is calculated. Imputation problems are also present as the entire net revenue is divided among only the limited resources. Nevertheless, the behavior of these values is analogous to that of marginal productivities. As the rate of factor-product transformation increases, the estimated resource efficiencies from the linear programing solution increase. Similarly, an increase in the product price will increase the value of the resource as estimated by linear programing.

investments in fertilizer, however, will return less than the present investments in fertilizer. As the use of land is restricted and the price of corn is increased by all of the programs, capital in the form of fertilizer may be substituted profitably for land. This would reduce the amount of land and increase the amount of capital used to produce a bushel of corn.[15] With more capital combined with each acre of land in corn, the yield per acre would increase, but the additional profit from each successive dollar would be smaller. Capital would return less when invested in sorghum production than when invested in corn production.

The return to land per acre would be increased on all farms studied through compliance with any of the programs. It would be increased relatively more on the smaller farms because the acreage of corn has stayed closer to the historical average on the small than on the large farms.[16] On the average, the large farms have a lower return to land than the small farms because they have larger acreages of steep and eroded soils on which yields are lower.

[15] Under the condition of decreasing marginal returns to all factors and decreasing marginal rate of factor substitution, any increase in capital relative to land would cause the marginal value product of capital to decline and the marginal value product of land to increase.

[16] This is not by design on the part of the County Agricultural Stabilization Committee, but probably because more appeals for increased base acreages are received from small farmers. A sample of farms indicated that, on the average, bases on 160-acre farms were 3 percent larger than historical average acreages, while 400-acre farms had bases 2 percent smaller than historical average acreages.

The value per acre for additional cropland that would yield the same return for capital invested in land as capital invested elsewhere in the farm business is indicated by the "estimated valuation of land" shown in tables 13 and 14. The estimated valuations are not to be confused with market prices for farmland. The relative figures show only that the program exerts pressure on land values. The value is higher for farms in compliance with each of the programs but especially for livestock farms. Although the estimated valuation of land is higher for cash-grain farms in compliance, it is below current market prices. To maximize profit, cash–grain farmers should expand livestock production before they expand the size of their farms.

Although all the programs affect land value, they differ little in their tendency to raise the returns to land. Returns to land are influenced more by application of fertilizer, system of farming, size of farm, and quality of land than by the particular production-control program in operation.

Adding land to a 160-acre livestock farm in compliance with a 1956-type program would be more profitable use of capital than investment in a beef cattle-feeding program. Expansion to at least a 300- to 400-acre farm would be possible with the labor supply of one man and family labor with average labor efficiency. The price of land could rise to $170 per acre before further intensification of the business would be more profitable than expansion of acreage.

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APPENDIX

Typical farms were used as units of analysis in the study reported. These farms are defined in terms of resources available, alternative enterprises considered, and transformation relationships. Each of these parameters of the typical farm is important in establishing the production alternatives available to the farm operator.

Resources

Land is the most fixed of the resources used on the farm. Its productivity involves both soils and climate. The soils are those on the typical farms of the Shelby–Grundy–Haig soil association. They developed under grass from Kansan drift or glacial till covered to varying depths by a layer of fine loess. The Shelby soil, which had the thinnest original covering of loess, has lost most of it through erosion. Shelby is a light-colored, compact, plastic, slowly permeable clay or clay loam, subject to erosion. The darker Grundy soils were formed from fine loess on slopes of 1 to 8 percent. When the slope is more than 2 percent, erosion is a problem. In seasons of above-average rainfall, Grundy soils are poorly drained and wet. The very dark Haig soil was formed from fine loess on flat ridgetops. This soil needs artificial drainage, but tile is of little value. Erosion, drainage, and drought are soil-management problems on most farms in southern Iowa. The 5-year average yield of corn in the area is about 35 bushels per acre.

The average acreage of land in each of the several soil types and slope classes on typical farm situations was determined from a sample of 10 selected farms. The average distribution approximated closely the average of all land in the soil-association area. The land was divided into four productivity classes by combining soil types and slope groups as follows: Class A land, Grundy and Haig silt loam, 0 to 8 percent slope; class B land, Shelby silt loam, 4 to 7 percent slope; class C land, Shelby silt loam, 8 to 12 percent slope; and permanent pasture, which consists of bottomland and Shelby silt loam with more than 12 percent slope. The amount of each class of land available on farms of typical sizes is given in table 15.

The Shelby silt loam is further divided into moderately eroded (erosion class 2) or severely eroded (erosion class 3). This is a useful division because of the differences in yield and response to fertilizer.

Capital is a critical resource in southern Iowa. It greatly affects farm organization and is usually scarce. The capital available for allocation among alternatives in planning an optimum organization was that currently used by average cash–grain or livestock farmers in the area when not complying with any production-control program. Several capital levels were studied because amounts of capital used have been shown to affect optimum farm organizations. One of the objectives of the study was to discover the capital situations under which it pays to comply with each program.

TABLE 15.—*Acreage of land by size of farm and classification of land, southern Iowa*

Size of farm (acres)	Classification				
	Class A	Class B	Class C	Permanent pasture	Waste
	Acres	*Acres*	*Acres*	*Acres*	*Acres*
160	44	11	54	37	14
240	62	16	76	69	17
400	65	36	149	125	25

The operating capital available for each of the typical farm situations studied was as follows: Farm 1, an owner-operated 160-acre cash–grain farm, $2,515; farm 2, a tenant-operated 240-acre cash–grain farm, $3,188; farm 3, an owner-operated 160-acre livestock farm, $6,421; farm 4, a tenant-operated 240-acre livestock farm, $8,528; the same amount of capital is available for production plans both with and without control programs.

Operating capital is defined as the amount available at the beginning of the planning period for annual crop and livestock expenses and investment in livestock and movable livestock equipment. Investment in machinery, buildings, household expenses, and land is not included in operating capital. Nor are the annual fixed costs of these investment items included.

In general, labor is plentiful on typical farms in southern Iowa. The 1954 Census of Agriculture reported 1.45 man equivalents, or about 3,000 hours of family labor, available each year on the average commercial farm in the hog–beef raising area. The alternative of hiring labor was not considered. The following tabulation shows the amount of labor available in each of five time periods:

Time Period	Labor available Hours
Early spring (March and April)	540
Late spring (May and June)	555
Summer (July and August)	555
Fall (September, October, and November)	695
Winter (December, January, and February)	655

Farm production plans were limited by the amounts of land, labor, and capital available, and by other special restrictions. The poultry enterprise was limited to a farm flock of 100 hens and 240 straight-run chicks because housing is not usually available for a larger flock. Dairy was limited to 5 cows because most southern Iowa farmers are not willing to expand dairying beyond a small supplementary herd to provide a dependable monthly income. A good market for cream exists for most farmers, but a market for grades B or A milk is available to only a few farmers near the larger towns.

The production-control programs provide special restrictions on production plans for farmers who comply with them. Historical cropping systems are used as a guide by the Agricultural Stabilization and Conservation Committees in distributing allotments among farms. Historical cropping patterns in the area, cropping systems in optimum farm plans without a control program, and the record of allotment adjustments made by township Agricultural Stabilization and Conservation committeemen were considered in setting acreage allotments for the study. A list of the acreage restrictions for each of the programs studied, by farm situations, is given in table 16.

A summary of the resources available and the special restrictions on the dairy and poultry enterprises for each of the typical farms studied is presented in table 17.

TABLE 16.—*Acreage restrictions specified for four typical farms, by three types of production-control programs, southern Iowa*

Restriction	Farm [1]			
	1	2	3	4
	Acres	*Acres*	*Acres*	*Acres*
Historical base acreage	37. 7	70. 3	37. 7	47. 3
1956-type program:				
Corn allotment [2]	27	51	27	34
Corn soil bank base [3]	32	61	32	40
Farm soil bank base [4]	67. 8	119	67. 8	96
Corn-base-acreage program:				
Corn allotment	0	0	0	0
Corn soil bank base [5]	31. 4	58. 6	31. 4	39. 5
Farm soil bank base	67. 8	119	67. 8	96
1957-type program:				
Corn allotment [6]	22. 8	43	22. 8	29
Corn soil bank base	0	0	0	0
Farm soil bank base [4]	67. 8	119	67. 8	96

[1] Farm 1 is a 160-acre owner-operated cash–grain farm. Farm 2 is a 240-acre tenant-operated cash–grain farm. Farm 3 is a 160-acre owner-operated livestock farm. Farm 4 is a 240-acre tenant-operated livestock farm.
[2] 72 percent of historical base.
[3] 86 percent of historical base.
[4] Average acreage of soil bank base crops in 1955–56 and succeeding years. It includes corn, oats, soybeans, grain sorghum, and acreage reserve.
[5] 83 percent of historical base.
[6] 61 percent of historical base.

Alternative Enterprises

The competing enterprises selected for analysis were those typical to the area. If other enterprises were used in plans for the farms whose operators were in compliance with control programs, these optimum plans are labeled as special adjustment alternatives.

TABLE 17.—*Resource and special programing restrictions for four typical farm situations, southern Iowa*

Resource or restriction	Unit	Farm [1]			
		1	2	3	4
Total land in farm	Acre	160	240	160	240
Cropland	do	109	154	109	154
Class A	do	44	62	44	62
Class B	do	11	16	11	16
Class C	do	54	76	54	76
Permanent pasture	do	37	69	37	69
Poultry	Number	100	100	100	100
Dairy cows	do	5	5	5	5
Labor supply [2]	Hour	3, 000	3, 000	3, 000	3, 000
Operating capital	Dollar	2, 515	3, 188	6, 421	8, 528

[1] See footnote 1, table 16.
[2] In the hog-beef raising area, the average farm has 1.45 unpaid family workers per farm. In this analysis, 3,000 hours are made available on all basic situations. See table 3.

The crop enterprises entered the analysis as alternative rotations. Combinations of crop rotations allow a wide range of cropping patterns. Three basic rotations were considered for all classes of land—corn–corn–oats–meadow, corn–corn–oats–meadow–meadow, and corn–oats–meadow. Special high-grain rotations including soybeans were considered for class A land (Grundy–Haig soil with a slope up to 8 percent). A special rotation (sorghums for grain, oats, and 2 years of meadow) was considered as a special adjustment alternative under a 1956-type program.

The livestock enterprises used in the analysis were farm chickens, hogs, milk cows, beef cows, and fattening of home-raised beef calves. Sheep, turkeys, and other minor livestock enterprises are found on a few farms. They were not included in the analysis as they may require management skills not available on typical farms.

Two special land use alternatives—acreage reserve and conservation reserve—were considered in all program situations. These alternatives were considered as individual activities; they were not incorporated into any rotation.

The enterprises were related to the resources through transformation coefficients.

Input–Output Data

The labor requirements for crop and livestock enterprises and special land uses are given in table 18. The labor requirements reflect the typical management practices of the area. As labor is plentiful on most farms in the area, the variation in actual labor efficiency among operators does not affect the alternative farm organizations.

TABLE 18.—*Labor requirements for crop and livestock enterprises, and special land uses*

Item	Unit	Season [1]					Total
		Winter	Early spring	Late spring	Summer	Fall	
		Hours	*Hours*	*Hours*	*Hours*	*Hours*	*Hours*
Corn	Acre	0. 4	0. 8	2. 7	0. 7	2. 2	6. 8
Oats	do	0	1. 6	0	3. 1	0	4. 7
Soybeans	do	0	. 6	2. 3	. 7	1. 9	5. 5
Hay	Ton	0	0	1. 2	1. 0	. 9	3. 0
Hogs (litters)	Number	6. 7	7. 3	2. 4	4. 0	7. 9	28. 3
Dairy cows	do	40. 1	26. 5	24. 3	21. 7	32. 9	145. 5
Poultry (100 hens)	do	44. 1	47. 8	58. 8	43. 2	41. 2	235
Beef cows	do	5. 7	3. 8	2. 9	2. 7	3. 5	18. 6
Feeding calves	do	3. 0	2. 0	4. 8	5. 8	10. 2	25. 8
Conservation reserve	Acre	0	1. 6	. 6	. 4	0	2. 6
Acreage reserve	do	0	0	. 6	. 4	0	1. 0

[1] Labor requirements are grouped into 5 labor periods corresponding to seasons of the year:
Winter includes December, January, and February.
Early spring includes March and April.
Late spring includes May and June.
Summer includes July and August.
Fall includes September, October, and November.

The capital input, the physical outputs, and the gross and net revenues for crop rotations are given by items and by classes of soil in tables 19 to 22. The quantities of fertilizer nutrients applied per rotation and the associated yields are given for low and medium levels of fertilization. The low level of fertilization is used throughout the study except in the special adjustment alternatives that use improved crop-production practices. The low rate represents about the same total amount of fertilizer as is currently applied in the area. The yields for crop rotations were estimated by the Agronomy Department of Iowa State College.

Special land-use alternatives used only in the optimum plans for program compliance situations are shown in table 23. The acreage reserve is essentially a land-rental alternative, as the only costs involved are those of controlling weeds. The rate of payment for acreage reserve is 60 percent of the 1956 support price for corn times the normal yield for corn. In southern Iowa, the normal yield is about 33.7 bushels and in 1956, the support price was $1.47 per bushel. Thus, the average acreage-reserve payment is $29.66 per acre. Only the land the farmer withholds from production of corn when complying with one of the control programs is eligible for payment under the acreage reserve.

TABLE 19.—INPUT–OUTPUT DATA PER ROTATION FOR CLASS A LAND: *Specified rotations and fertilizer levels using 2-plow machinery, 1956 prices* [1]

Item	Unit	Rotation and level of fertilizer [2]											
		C–Sb–C–O–M		C–C–O–M		C–C–O–M–M		C–O–M		C–Sb–C–O–M–M		C–Sb–C–O–M–M–M	
		Low	Medium	Low	Medium	Low	Medium	Low	Medium	Low	Medium	Low	Medium
Inputs:													
Land	Acre	5	5	4	4	5	5	3	3	6	6	7	7
Seed	Dollar	15. 54	15. 54	10. 80	10. 80	10. 80	10. 80	8. 76	8. 76	15. 54	15. 54	15. 54	15. 54
Fertilizer:													
Nitrogen	Pound	35	65	45	80	45	70	20	25	35	65	35	65
Phosphorus	do	50	70	50	70	50	70	35	50	50	70	50	70
Potassium	do	20	20	20	20	20	20	10	10	20	20	20	20
Expense	Dollar	11. 96	18. 64	13. 44	20. 90	13. 44	19. 40	7. 44	9. 86	11. 96	18. 64	11. 96	18. 64
Tractor and machinery	do	35. 91	36. 43	27. 52	28. 12	27. 60	28. 28	17. 33	17. 75	35. 91	36. 43	35. 91	36. 43
Total annual expense	do	63. 41	70. 61	51. 76	59. 82	51. 84	58. 48	33. 53	36. 37	63. 41	70. 61	63. 41	70. 61
Outputs:													
Soybeans	Bushel	22	25	------	------	------	------	------	------	22	25	22	25
Corn	do	117	135	115	135	117	140	60	70	117	135	117	135
Oats	do	30	35	30	35	30	35	35	35	30	35	30	35
Corn equivalent [3]	do	132	152. 5	130	152. 5	132	157. 5	77. 5	87. 5	132	152. 5	132	152. 5
Hay equivalent [4]	Ton	2. 2	2. 5	2. 2	2. 5	4. 4	5. 6	2. 2	2. 5	4. 4	5. 0	6. 6	7. 5
Gross revenue	Dollar	204. 60	235. 50	156. 00	183. 00	158. 40	189. 00	93. 00	105. 00	204. 60	235. 50	204. 60	235. 50
Net revenue	do	141. 19	164. 89	104. 24	123. 18	106. 56	130. 52	59. 47	68. 63	141. 19	164. 89	141. 19	164. 89

[1] Class A land—Grundy–Haig soil with a slope up to 8 percent.
[2] See table 1, footnote 2, for explanation of symbols.
[3] Corn equivalent of corn and oats. 2 bushels of oats equal 1 bushel of corn.
[4] Hay equivalent of hay and pasture.

TABLE 20.—INPUT–OUTPUT DATA PER ROTATION FOR CLASS B LAND: *Specified rotations and fertilizer levels using 2-plow machinery, 1956 prices* [1]

Item	Unit	Rotation and level of fertilizer [2]									
		C–C–O–M		C–C–O–M–M		C–O–M		C–O–M–M		C-O-M-M-M-M	
		Low	Medium	Low	Medium	Low	Medium	Low	Medium	Low	Medium
Inputs:											
Land	Acre	4	4	5	5	3	3	4	4	6	6
Seed	Dollar	10. 80	10. 80	10. 80	10. 80	8. 76	8. 76	8. 76	8. 76	8. 76	8. 76
Fertilizer:											
Nitrogen	Pound	50	95	50	95	20	35	15	35	15	15
Phosphorus	do	70	140	70	140	50	80	50	90	65	130
Potassium	do	20	20	20	20	10	10	10	10	10	10
Lime	Ton	1. 0	1. 5	1. 0	1. 5	------	------	------	------	------	1. 5
Expense	Dollar	17. 40	35. 34	17. 40	35. 34	9. 10	14. 66	8. 34	15. 76	10. 00	21. 65
Tractor and machinery	do	25. 84	26. 44	26. 00	26. 76	16. 57	16. 89	16. 73	16. 97	16. 79	16. 79
Total annual expense	do	54. 04	72. 58	54. 20	72. 90	34. 43	40. 31	33. 38	41. 49	35. 55	47. 20
Output:											
Corn	Bushel	59	79	64	89	35	45	40	48	42	48
Oats	do	26	35	28	35	30	35	32	35	35	35
Corn equivalent [3]	do	72	96. 5	78	106. 5	50	62. 5	56	65. 5	59. 5	65. 5
Hay equivalent [4]	Ton	1. 7	2. 5	3. 0	5. 0	1. 8	2. 5	4. 0	5. 2	6. 4	9. 2
Gross revenue	Dollar	86. 40	115. 80	93. 60	127. 80	60. 00	75. 00	67. 20	78. 60	71. 40	78. 60
Net revenue	do	32. 36	43. 22	39. 40	54. 90	25. 57	34. 69	33. 37	37. 11	35. 85	31. 40

[1] Class B land—Shelby soil with a slope of 4 to 7 percent.
[2] See table 1, footnote 2, for explanation of symbols.
[3] Corn equivalent of corn and oats. 2 bushels of oats equal 1 bushel of corn.
[4] Hay equivalent of hay and pasture.

TABLE 21.—INPUT–OUTPUT DATA PER ROTATION FOR CLASS C LAND: *Specified rotations and fertilizer levels using 2-plow machinery, 1956 prices* [1]

Item	Unit	Rotation and level of fertilizer [2]									
		C–C–O–M		C–C–O–M–M		C–O–M		C–O–M–M		C-O-M-M-M-M	
		Low	Medium	Low	Medium	Low	Medium	Low	Medium	Low	Medium
Inputs:											
Land	Acre	4	4	5	5	3	3	4	4	6	6
Seed	Dollar	10. 80	10. 80	10. 80	10. 80	8. 76	8. 76	8. 76	8. 76	8. 76	8. 76
Fertilizer:											
Nitrogen	Pound	50	95	50	95	20	35	15	35	15	35
Phosphorus	do	70	140	70	140	50	80	50	90	65	130
Potassium	do	20	20	20	20	10	10	10	10	10	10
Lime	Ton	1. 0	1. 5	1. 0	1. 5	1. 0	1. 5	-------	1. 5	-------	1. 5
Expense	Dollar	19. 40	35. 35	19. 40	35. 35	12. 10	19. 15	8. 35	20. 25	10. 00	21. 65
Tractor and machinery	do	25. 72	26. 30	25. 88	26. 64	16. 49	16. 79	16. 67	16. 89	16. 73	16. 89
Total annual expense	do	55. 92	72. 45	56. 08	72. 79	37. 35	44. 70	33. 78	45. 90	35. 49	47. 30
Outputs:											
Corn	Bushel	55	74	60	85	32	42	38	45	40	45
Oats	do	25	35	27	35	30	35	32	35	35	35
Corn equivalent [3]	do	67. 5	91. 5	73. 5	102. 5	47	59. 5	54	62. 5	57. 5	62. 5
Hay equivalent [4]	Ton	1. 6	2. 5	3. 6	5. 0	1. 8	2. 5	3. 8	5. 0	6. 0	8. 8
Gross revenue	Dollar	81. 00	109. 80	88. 20	123. 00	56. 40	71. 40	64. 80	75. 00	69. 00	75. 00
Net revenue	do	25. 08	37. 35	32. 12	50. 21	19. 05	26. 70	31. 02	29. 10	33. 51	27. 70

[1] Class C land—Shelby soil with a slope 8 to 12 percent.
[2] See table 1, footnote 2, for explanation of symbols.
[3] Corn equivalent of corn and oats. 2 bushels of oats equal 1 bushel of corn.
[4] Hay equivalent of hay and pasture.

TABLE 22.—INPUT–OUTPUT DATA PER ROTATION FOR SEVERELY ERODED CLASS B AND CLASS C LAND: *Specified rotations and fertilizer levels using 2-plow machinery, 1956 prices*

Item	Unit	Rotation and level of fertilizer [1]									
		C–C–O–M		C–C–O–M–M		C–O–M		C–O–M–M		C-O-M-M-M-M	
		Low	Medium	Low	Medium	Low	Medium	Low	Medium	Low	Medium
Inputs:											
Land	Acre	4	4	5	5	3	3	4	4	6	6
Seed	Dollar	10. 80	10. 80	10. 80	10. 80	8. 76	8. 76	8. 76	8. 76	8. 76	8. 76
Fertilizer:											
Nitrogen	Pound	55	120	45	110	25	60	25	50	25	50
Phosphorus	do	70	165	70	180	50	105	50	120	65	140
Potassium	do	20	20	20	20	10	10	10	10	10	10
Lime	Ton	1. 0	1. 5	-------	-------	-------	-------	-------	-------	-------	-------
Expense	Dollar	20. 15	41. 85	17. 15	37. 50	9. 85	21. 15	9. 85	21. 30	11. 50	23. 50
Tractor and machinery	do	25. 43	25. 88	25. 73	26. 17	16. 28	16. 58	16. 43	16. 67	16. 58	16. 73
Total annual expense	do	56. 38	78. 53	53. 68	74. 47	34. 89	46. 49	35. 04	46. 73	36. 84	48. 99
Outputs:											
Corn	Bushel	45	60	55	69	25	35	30	38	35	40
Oats	do	20	30	20	30	20	30	20	30	25	30
Corn equivalent [2]	do	55	75	65	84	35	50	40	53	47. 5	55
Hay equivalent [3]	Ton	1. 5	2. 5	2. 6	4. 6	1. 5	2. 5	2. 6	4. 6	5. 2	8. 8
Gross revenue	Dollar	66. 00	90. 00	78. 00	100. 80	42. 00	60. 00	48. 00	63. 60	57. 00	66. 00
Net revenue	do	9. 62	11. 47	24. 32	26. 33	7. 11	13. 51	12. 96	16. 87	20. 16	17. 01

[1] See table 1, footnote 2, for explanation of symbols.
[2] Corn equivalent of corn and oats. 2 bushels of oats equal 1 bushel of corn.
[3] Hay equivalent of hay and pasture.

TABLE 23.—*Input-output data per rotation for special land alternatives used only in the optimum plans for farm programs*

Item	Unit	Use of land				
		S-O-M-M [1 2]		Conservation reserve		Acreage reserve
		Low	Medium	5 years	3 years	
Inputs:						
Land	Acre	4	4	1	1	1
Seed	Dollar	7. 76	7. 76	6. 79	6. 79	----------
Fertilizer:						
Nitrogen	Pound	15	35	10	10	----------
Phosphorus	----do	50	90	45	45	----------
Potassium	----do	10	10	----------	----------	----------
Lime	Ton	----------	1. 5	----------	----------	----------
Expense	Dollar	8. 35	20. 25	6. 45	6. 45	----------
Tractor and machinery	----do	20. 93	21. 90	5. 40	4. 04	. 68
Total annual expense	----do	37. 04	49. 91	1. 60	5. 76	. 68
Outputs:						
Sorghum grain	Pound	2, 500	2, 950	----------	----------	----------
Oats	Bushel	32	35	----------	----------	----------
Hay	Ton	3. 8	5. 0	----------	----------	----------
Gross revenue	Dollar	73. 20	84. 60	10	10	29. 66
Annual net revenue	----do	36. 16	34. 69	8. 40	4. 24	28. 98

[1] See table 1, footnote 2, for explanation of symbols.
[2] For class C land only.

The conservation reserve, which is also a land-rental program, removes cropland from production. An approved conservation practice, usually grass, must be established and the land rented for a period of 3, 5, or 10 years. The annual rate of payment used in the analysis was $10 per acre. If the rental is for 5 years, 80 percent of the seed costs ($6.79) and 80 percent of the costs of fertilizer needed to establish a seeding ($6.45) are paid by the Government through the Conservation Reserve Program. The $2 initial machinery cost for seeding and the 68 cents per year for mowing must be borne by the operator. The net return per acre to the operator would be somewhat lower during the first year, but during the 5-year period, it would average $8.40.

Sorghums are rapidly increasing as a minor crop in southern Iowa. The yield of sorghums for grain is estimated to be 18 percent higher than the yield of corn when grown on the less productive land. Drying sorghum grain, which is essential, costs about 5 cents per bushel plus one-half cent per 1 percent of moisture removed. Sorghum seed costs about 12.5 cents a pound, and usually 8 pounds per acre are needed. Tillage and harvest costs are similar to those for soybeans, and fertilizer needs are similar to those of corn.

The gross revenue for the various crop rotations in tables 19 to 23 is calculated by using the appropriate crop yields shown in the respective tables and the appropriate commodity prices on page 32. Hay is not sold commercially in the area; it is marketed chiefly through livestock. Thus the annual expense and capital requirement for a crop rotation does not include the cost of harvesting hay, nor does the gross revenue of the rotation include a market value for hay. As hay would be harvested only if it were to be fed to livestock, the cost of harvesting hay is included in the livestock expenses and capital requirements.

The cost of using farm machinery and seed on individual crops is given in table 24. The costs of operating farm machinery included in table 24 are those for fuel, lubrication, and repairs. These costs vary with the number of acres of each crop in the production plan. The costs of owning farm machinery, such as depreciation, housing, insurance, taxes, and interest on investments, do not vary with the production plans. These costs are fixed; they do not affect the choice among production plans from year to year. An itemized list of machinery investments and annual fixed costs is presented in table 25.

Capital investment and annual costs for livestock enterprises are given in table 26. The level of efficiency reflected by the input-output data is typical of the production practices used on farms in southern Iowa.

TABLE 24.—SEED AND VARIABLE MACHINERY COSTS PER ACRE: *Specified crops, by size of farm, 1956 prices*

Crop	Seed cost	Variable machinery costs	
		160-acre farm	240- and 400-acre farms
	Dollars	*Dollars*	*Dollars*
Corn	2.00	[1] [2] 8.54	[2] 4.83
Oats	1.81	[1] 6.99	7.00
Soybeans	4.63	[1] 8.31	[1] 8.60
Meadow	4.97	[3] 4.91	[3] 5.08

[1] Includes custom harvesting charge of $5 per acre.
[2] Does not include a 3-cent per bushel charge for shelling corn.
[3] Cost per ton; includes custom baling cost of $3.90 per ton of hay.

TABLE 25.—FARM MACHINERY COSTS: *Investment and annual fixed cost, by size of farm, 1956 prices*

Item	160-acre farm		240-acre farm	
	Investment	Annual fixed cost	Investment	Annual fixed cost
	Dollars	*Dollars*	*Dollars*	*Dollars*
Tractor	1,695	215.26	2,380	302.26
Plow	196	19.80	298	30.10
Disk	280	25.20	577	51.93
Harrow	185	12.42	185	12.42
Planter	191	15.66	191	15.66
Cultivator	232	21.34	232	21.34
Picker	1,170	148.59	1,170	148.59
Wagon	375	28.88	375	28.88
Drill	425	41.65	425	41.65
Combine			1,375	199.38
Mower	275	34.93	275	34.93
Side delivery rake	455	47.78	455	47.78
Fertilizer spreader	200	17.60	200	17.60
Side dresser	105	9.24	105	9.24
Manure spreader	525	42.00	525	42.00
Elevator	500	30.00	500	30.00
Manure loader			299	27.00
Total	6,809	710.35	9,567	1,060.76

Poultry.—Although there are almost no large commercial flocks, more than 90 percent of the farms have small family-sized flocks. Flocks average about 100 laying hens and 240 chicks, but the size varies from farm to farm according to personal preferences and building facilities.

For purposes of the study, it was assumed that a production unit consists of 100 laying hens and that 240 straight-run chicks are bought annually. Death loss of chicks is 10 percent. One hundred and eight 3-pound cockerels are sold or used in the household. Seven percent of the pullets raised are culled, and the remaining 100 are moved into the laying flock at 5 or 6 months of age. Annual death loss of hens amounts to 15 percent.

Eggs are produced at the rate of 172 eggs per hen per year. In addition, 7.81 pounds of meat—4.25 pounds of cull hen, 0.32 pound of cull pullet, and 3.24 pounds of cockerel—are produced for each hen in the laying flock. Feed requirements per hen include 1.11 bushels of corn equivalent and 25.67 pounds of commercial feed for the laying flock and 0.36 bushel of corn equivalent and 17.76 pounds of commercial feed for replacements and cockerels.

Dairy.—Approximately 80 percent of the farmers have at least one cow and the herds average about five cows. Less than 10 percent of the farmers have more than 10 dairy cows.

The dairy enterprise used is representative of the small herds common to the area. The milk cow produces 6,000 pounds of milk containing 4 percent butterfat. The cream is separated and sold to a local creamery. Cows are bred to calve at 14-month intervals. Bull calves are sold as 110-pound vealers. All heifer calves are raised, and those not needed as replacements are sold as 2-year-olds. Cows are replaced every 5 years by heifers raised in the herd. A milk cow and the associated young stock together consume 31.4 bushels of grain, 3.7 tons of hay, and 2.7 tons of hay equivalent in the form of pasture.

Beef.—Herds of beef cows are found on about two-thirds of the farms. Beef herds average 17 cows. Beef calves are sold when they weigh about 450 pounds. On the larger farms some cattle are fattened, but most feeding operations are small.

The alternative of fattening beef cattle was not considered in the optimum plans without compliance with a farm program.

A breeding herd consisting of 1,100-pound cows is typical. Cows are replaced at the end of 8 years by heifers raised on the farm. A 90-percent calf crop is average. Twelve percent of the calves are kept for replacements and 78 percent are sold. Feed requirements for a cow and replacements are 6.7 bushels of grain and 5.5 tons of hay equivalents. About 80 percent of the forage requirements are supplied by pasture.

In the beef-feeding enterprise, home-raised calves are wintered on roughage, pastured for 90 days without grain, placed on full feed for 120 days, and sold around December 1 of the following year as 1,000-pound fat yearlings. Fifty-two bushels of grain and 2¼ tons of hay equivalent

TABLE 26.—*Input-output data for livestock enterprises by production unit, southern Iowa*

Item	Unit	Livestock enterprise				
		Average management, 1 milk cow	Deferred-fed calves, 1 calf	Beef cattle breeding herd: 1 cow	Hogs: 2 spring and 1 fall litter	Poultry flock: 100 hens, 240 chicks
Feed requirements:						
Corn equivalent	Bushel	31.4	52.0	6.7	333.84	147
Protein supplements	Cwt	1.92	1.25		20.33	43.43
Hay	Ton	3.74	.80	1.15	1.44	0
Pasture	do	2.61	1.44	4.32	0	0
Capital investment:						
Basic stock	Dollar	144.00		151.25	65.25	100.00
Equipment	do	39.50	6.77	17.50	33.19	110.00
Replacement stock	do	42.97		22.48		
Total		226.47	6.77	191.23	98.44	210.00
Annual cash expense:						
Protein supplement	do	8.48	5.25		81.44	203.03
Shelter and equipment use	do	9.20	1.30	2.90	6.63	12.55
Miscellaneous [1]	do	15.81	2.75	4.58	44.85	29.46
Machine service [2]	do	3.15	2.47	1.77	11.48	6.04
Hay harvesting [3]	do	18.73	4.01	5.76		
Manure hauling	do	7.14	1.18	2.08	3.09	
Chicks	do					39.60
Death loss	do		1.96			
Feeder stock	do		90.00			
Total	do	62.51	108.92	17.09	147.49	290.68
Capital coefficient [4]	do	231.68	115.69	208.32	245.93	249.60
Building space	Square feet	48	20	48	45	412
Products:						
Cull cows	Pound	250		138		
Calves	do	45	1,000	3,354		
2-year-old heifers	Head	.12				
Butterfat	Pound	236				
Pigs weaned	Number				20.04	
Butcher hogs	Pound				3,875	
Sows	do				700	
Eggs	Dozen					1,433
Cockerels and cull pullets	Pound					356
Cull hens	do					425
Gross revenue	Dollar	191.11	212.50	88.76	645.88	580.57
Annual cash expense	do	62.51	108.92	17.09	147.49	290.68
Value of grain	do	37.65	62.40	8.02	400.61	176.40
Net revenue	do	90.95	41.18	63.65	97.78	113.49

[1] Includes insurance, taxes, mineral, veterinary, electricity, medicine, and breeding fees.
[2] Includes tractor operation and repair, use of other machinery, use of truck and automobile.
[3] Based on custom rate for bailing.
[4] The capital coefficient is the sum of capital investment and capital for annual expenses. For dairy, only $\frac{1}{12}$ of annual expenses are included in the capital coefficient because of the possibility of reusing the capital for annual expenses on the enterprise. For poultry, only the purchase cost of chicks is included for the same reason.

are needed to feed out each calf. Death loss during the growing and feeding period is estimated at 2½ percent.

Hogs.—Approximately 70 percent of the farms in this area have hog enterprises. Like beef, the size of the hog enterprise is related to the quantity of feed produced on the farm. The average per farm reporting any sows ranges from 7 litters for the 80-acre farms to 18 litters for the 400-acre farms. About twice as many spring as fall litters are raised.

Half of the sows are used to produce 2 litters per year, and the others are sold after the spring litter is weaned. Replacements are taken from the spring litter.

Pigs weaned per litter average 6.745. Total production of pork from 3 litters and two 350-pound sows amounts to 4,575 pounds. Feed re-

quirements for 3 litters are 333.9 bushels of corn and 1.44 tons of hay equivalent.

Sheep.—Small flocks of sheep are found on about 20 percent of the farms. Sheep yield a high return to capital and provide an excellent means for farmers with limited capital to make use of surplus forage. But many farmers do not possess the specialized management skills needed, and many dislike sheep. Dogs are a menace, and many farmers do not have sheep-tight fences. Sheep were not included in the study reported.

Prices.—The prices used in the study are given below. They reflect the 1956 level of prices and relative relationships among commodities. The prices are those received at the farm; thus they do not include marketing costs. As prices are subject to variation and are important in determining optimum organizations, some of the key prices given in some sections of the analysis were varied.

Product	*Price and unit*
Corn sold	$1.20 per bushel.
Corn bought	1.30 per bushel.
Corn sealed, 1956 program	1.44 per bushel.
Corn sealed, Corn Base Acreage Program	1.25 per bushel.
Corn sealed, 1957 program	1.30 per bushel.
Oats	.60 per bushel.
Soybeans	2.10 per bushel.
Sorghum grain	2.16 per cwt.
Conservation reserve	10.00 per acre.
Acreage reserve	29.66 per acre.
Eggs	.295 per dozen.
Hens	.153 per pound.
Fryer chickens	.262 per pound.
Cream	.595 per pound butterfat.
Cull milk cow	10.00 per cwt.
2-year-old dairy heifer	144.00 per head.
Veal calf	18.00 per cwt.
Beef calves	20.00 per cwt.
Cull beef cows	13.00 per cwt.
Fat beef calves	21.25 per cwt.
Butcher hogs	14.50 per cwt.
Sows	12.00 per cwt.

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